



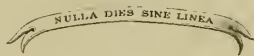
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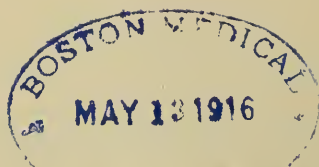
# THEORY AND PRACTICE OF BLOODLETTING

BY  
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NEW YORK  
REBMAN COMPANY



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## PREFACE

SINCE the appearance of Strubell's book in 1905, no author has attempted to write a comprehensive treatise on bloodletting in its relations to theoretical and practical medicine. Much, however, has been published during this time on various special points connected with the subject. But all these writings related to only one phase of the subject, either reporting a series of experiments pertaining to the physiological side of bloodletting or setting forth the effects of venesection on this or that disease.

Whoever has devoted some attention to the periodical literature on bloodletting knows that in the last ten years the number of advocates of this remedial procedure has increased and that of its opponents decreased. The renaissance of bloodletting for therapeutic purposes is due merely to a better understanding of the functional changes following the operation, to a closer clinical observation of cases subjected to it, and to the fact that the efficacy of this method over many other measures has frequently been demonstrated and recognized.

If I interpret the trend of the times correctly, bloodletting, the oldest of man's remedies, will regain its full citizenship in the realm of therapeutics. Because of this probable revival I believe that I am justified in writing a book of limited scope, in which I shall try to set forth in a systematic manner the important progress of bloodletting, especially in its more recent experimental and clinical investigations. This progress is by no means confined to technical improvements or innovations and to the more exact limita-



tions of the indications and contraindications, but is also noticeable where, as in puerperal eclampsia for instance, the pathogenesis is still *sub judice*.

In the part of the book devoted to the special clinic of local and general bloodletting, I earnestly endeavored to adhere to a rational conservatism by discussing only such disease conditions in which blood abstraction furnishes definite and clinically demonstrated results. For this reason the bloodletting enthusiast will vainly search the following pages for references to bleeding in gout, rheumatism, neuralgia and other affections in which the procedure is neither indicated in a majority of the cases, nor yields or is able to yield favorable results.

Personally I am an advocate of the conditional employment of this ancient method, and I believe it unnecessary to state that I do not consider it a panacea, as Dyes, Schubert and others of its resuscitators do. That I have tried to preserve my unobstructed viewpoint and critical judgment in this respect, I hope is shown in those paragraphs of the book in which I have related my own clinical experiences.

In a separate chapter I have pointed out that bloodletting may, under certain conditions, serve as a prophylactic of no mean value.

The names of authors directly quoted are printed in italics, those referred to without consulting the original sources in roman type.

NEW YORK.

HEINRICH STERN.

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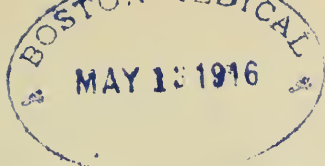


# **PART FIRST**

**GENERAL FUNDAMENTS OF BLOODLETTING**







## I. HISTORICAL RETROSPECT

### A. Bloodletting and Development of Civilization

Without the knowledge of its historical evolution, no branch of science can ever become an individual's true intellectual possession. Mastery of any one special field of scientific research can only be achieved when one has followed with patience and untiring zeal the many devious paths, the oft misleading, sometimes blind alleys of error which man's mind has traversed in its quest of the truth.

Bloodletting has often proved a boon, yet it has also done much harm. At various and for protracted periods it was reputed a panacea, a cure for all ills; and then again it was abandoned altogether for the possible harm which may have ensued through its employ. Thus medical art went from one extreme to the other. But when experimental physiology, pathology and therapeutics became the scientific fundamentals of medicine, the half-forgotten custom of our grandsires, freed from cobwebs and fancies strongly flavored with hocus-pocus, was resuscitated, its *modus operandi* studied, and its indications and contraindications defined in accordance with the prevailing conceptions of disease.

No branch of medicine has ever made an independent progress. Invariably the concept-principles of medicine in general influenced the evolutionary trend of each of its subordinate departments. These concept-principles, however, were in turn dependent upon the intellectual currents of the prevalent cultural period. The rise and decline, and the final revival of bloodletting as a therapeutic factor, can only be comprehended by the aid of the study of the history of

medicine and that of the development of civilization. The same views which prevailed in religion, philosophy and in what we now term biology, and which, as products of their time, dominated general thought and sentiment, have likewise determined the trend of medicine. Whether moving in the proper direction or turning into byways of error, of unreasonable supposition or of blind superstition, medicine has invariably followed the lead of general civilization.

The dependence of medicine on the general state of cultural development is strikingly illustrated by the vagrancies of bloodletting. In the following we shall see that together with the intellectual decline of the people there arose a systematized superstition, which reached its culminating point in the *medicina astrologica* so fiercely but vainly fought by *Mirandola* and *Fracastori*. To what extent the art of healing was dominated by the prevailing notions of the time—even far into the eighteenth century—may be learned from the rigid rules for the performance of artificial bleeding, which were based upon the constellation of the celestial bodies. Astrology which taught that the fate of man was governed by the moving stars, and which foretold the occurrence of certain events from their constellation, was a creation of its time, and even the most enlightened minds could not entirely free themselves from its mandates.

Nevertheless, the fact remains that there always had existed a fundamental difference between religious and medical superstition. If, for instance, venesection was not held permissible at the time of the conjunction of sun and moon, this was by no means due to the thought that some preter- or supernatural power made the operation more or less effective. It must not be forgotten that the numerous medical systems, from the



humoral pathology of the Hippocratic school to the cellular pathology of the nineteenth century—no matter how widely divergent their principles and doctrines may have been—all agreed in this, that their deductions were based upon processes displayed within the body of the patient, and that they scrupulously refrained from considering supernatural forces capable of producing or healing disease conditions. Even the unknown agent which all the medical systems required to explain the abnormal bodily processes was considered to be of a material nature. Medical superstition did not consist in attributing the causation of disease, its course and termination to the interference of metaphysical powers with the physical processes. Medical superstition was in reality nothing else but a wrong concept of nature. This wrong concept was the inevitable result of the application of deductive methods to scientific subjects. While *Bacon of Verulam*, the father of induction, established the fundamental principle that one ought to proceed from the individual observation, confirm the findings of the individual observation by experimentation, comparing the results with other individual observations, then classifying them according to their similarities and dissimilarities, and then constructing therefrom the general laws of nature—the deductive method, so called, inverted the process. It proceeded from general premises, a priori held as laws, and deduced from them the individual phenomena. The theory, for instance, that the sun rotates around the earth, produced in this manner the senseless and dangerous doctrine of the influence exercised by the aspects upon the functions of the human body, likewise the doctrine that the constellations were favorable or unfavorable to the operation of bloodletting. At any rate, the material forces governing

matter were always recognized by the physicians as the motive power to the exclusion of preternatural influences. Medical superstition with all its errors, therefore, never had any religious coloration, but was simply the outcome of a false observation of nature.

The profound influence which astrology exercised on medical science in general, and on the practice of bloodletting in particular, shows plainly that the development of bloodletting can only be understood from a careful study of the history of medicine, which in turn depends on the progress of civilization. Bloodletting in all its phases is but the reflex of the various periods of civilization. Its application was always governed by the intellectual current of the time, so in ancient days by the religious views of the Jews, Hindoos, Persians, etc., intermixed with observations of nature; later on by the systems of natural philosophy of *Aristotle*, *Hippocrates*, *Galen*, etc. In the Middle Ages Arabian medicine, coupled with magic and astrology, prevailed. In the beginning of the sixteenth century bloodletting was still under the sway of astrology and the teachings of Hippocrates, but with the discovery of the circulation of the blood manifold changes took place, until the inductive methods of investigation put it on a rational basis.

It would, of course, be rather difficult to draw a sharp line of demarcation between these different periods of history. Nobody, for example, will assert that medicine of the present day has much in common with that of the sixteenth century. The discrepancy is, in fact, so great that the medical doctrines of these two periods cannot be considered as belonging to the same historical epoch. Likewise the viewpoint from which venesection is regarded at this day is absolutely at variance from the viewpoints entertained at the be-

ginning of the present epoch. The invention of printing, the discovery of America, the reformation, the founding of the Copernican system, and other revolutionary achievements only introduced but did not make the new era. If I adhere, therefore, to the accepted division of Antiquity, Middle Ages and Modern Times, I do so simply for the sake of convenience, and not because it is demanded by the developmental history of the subject of bloodletting. In former times everybody had to be bled, whether hale or ill, young or old. Venesection was the alpha and omega of the healing art, and the art was practiced according to the rule laid down by *Botallus*, a much-vaunted medical authority of the seventeenth century: "The more foul water you draw from a well, the more pure water takes its place." King Louis XIII was bled forty-seven times within one year, one of his counsellors even sixty-four times—and heroic purgings on each occasion served as finishing touches of the procedure. All this is thoroughly changed to-day. How this transformation, from senseless squandering of blood to the rational abstraction of blood, has been accomplished by the development of the medico-biological sciences will be demonstrated in the following pages.

### B. Bloodletting in Antiquity

Podaleirios, a son of Æsculapius, was the first to open a superficial blood vessel for the purpose of withdrawing blood from the body. While on his return from Troy, he is credited with having saved the daughter of the Carian King Damœthus from the fatal consequences of a severe fall by withdrawing blood. Details concerning this case and its cure I have been unable to unearth from literature. Podaleirios, however, must have had experience in this practice, for it is not

likely that he performed the operation in a haphazard manner, running the risk of a father's ire and revenge in case the experiment failed. Neither can we sceptics of the twentieth century admit that he was possessed of peculiar supernatural gifts, or that his knowledge of the therapeutic effects of bloodletting was the result of divine inspiration. It is quite safe, hence, to assume that in his days venesection was understood (though historical data are missing) and that he was conversant with the practice. It is also possible that the royal maiden suffered only from a fright neurosis, a functional disturbance, and that the healing effect of the withdrawn blood was merely due to the influence of suggestion.

Bloodletting as a means of ameliorating or curing disease is undoubtedly of much longer existence than the pages of history record. Most of the ancient oriental as well as occidental peoples practiced it, and when we come across the first historical data, it appears that it had already long before been a well-established custom. The Egyptians treasured bloodletting as one of their most important remedies. There is a shrewd suspicion that the inhabitants of the valley of the Nile learned the therapeutic value of blood abstraction from animals, which would rub their skin against the sharp edges of the river reeds until the blood would flow, after which they apparently felt very well. The salutary effects of this auto-operation possibly prompted the ancient Egyptians to abstract blood in certain types of disease. Thus animal instinct may have been at the foundation of one of mankind's most important empirical remedies. By practical application the people of the Nile country found that bloodletting gave relief in certain disease conditions, but they could not, of course, account for its physiological

modus operandi. They knew nothing or entertained but the most naïve conceptions about the circulation of the blood, imminent cardiac paralysis due to pulmonary congestion, of normal and abnormal constituents of the blood, etc. The same, by the way, holds good of the entire field of therapeutics, which rested wholly upon empirical observations and were not an achievement of physiological and pathological investigations. And empiricism was the only dominant therapeutic factor not only in ancient times, but through all the Middle Ages, and even until the very threshold of our own times.

In Egyptian sarcophagi instruments for venesection have been found in excellent state of preservation. The very age of these implements proves that bloodletting was practiced thousands of years ago. The technique of bloodletting in these periods is also evidenced by the instruments, comprising lancets and cups. The lancets were used for slitting the skin, the cups for drawing the blood. The cups were generally made from the pointed ends of cattle-horns. In these, however, the air was not rarefied by heat or exhaustion, but the blood was removed by suction through a small hole drilled in the pointed end. One may infer that the bloodletting instruments found together with mummies would rather mean that depletion was one of the capital punishments in old Egypt. But why should the relatives, or the government, place valuable implements, rather costly for those days, into the sarcophagus and go to the expense and trouble of embalming the body of a man who was adjudged an enemy of society?

The Jews became acquainted with the art of bloodletting through the Egyptians, to whom they were tributary in more than the mere political respect for re-



peated periods. Later on Arabian influence is traceable in the medico-social history of the Jews. According to *Häser*, bloodletting was employed by the Jews rather as a prophylactic than a remedial agent. Dietetic bloodletting was ordered to be performed once a month until the sixtieth year was attained; after this it was practiced less frequently. Full-blooded persons were occasionally bled so energetically that they fainted or fell in convulsions. As a rule, from the sixth to the eighth part of the total amount of the blood was removed. With the limited knowledge of those days, this was, of course, chiefly guesswork, and thus the operation was rendered anything but an exact medical interference. Indications and contraindications for bloodletting were neither known to the Jews nor to the other peoples of Antiquity, and it required the sharp eye of the expert, trained by practice and observation, to pass judgment on the advisability of the operation. Based upon such unreliable practices, serious and even fatal mistakes were bound to follow. Such, however, will be the inevitable outcome when the favorable results obtained in certain instances are indiscriminately generalized and applied to suffering humanity without exception. Notwithstanding the many and manifold accidents connected with bloodletting of the Ancients, the people continued to have implicit faith in the procedure, and ever and anon reverted to its practice, ascribing failures to the victim rather than to the bad judgment of the operating artist.

The Persians and Chaldæans were more cautious as regards bloodletting. They either did not believe in its efficacy, or, what is more likely, their religious tenets prohibited the spilling of the blood of the members of their own race. At any rate, nothing concerning the withdrawal of blood for therapeutic purposes is men-

tioned in the meager fragments of their literature which has come down to us. In view of the fact that the ancient peoples did not lead an isolated existence, but had lively intercourse among themselves through commerce and expeditions of war and conquest, one can hardly assume that the Persians and Chaldæans should have been unaware of the art of bloodletting as practiced among other peoples. The sages of old Iran possibly rejected bloodletting for reason of its supposed weakening effects upon the organism, and disease that may result therefrom. Kindred reasons, very likely, must have also prevailed among the ancient Chinese, who had never adopted venesection as a remedial measure.

The Hindoos, on the other hand, held the artificial abstraction of blood in great favor. According to the teachings of *Susutra*, the best means for the preservation of bodily welfare are: Once a week an emetic, once a month a purge, twice a year (at the turn of the seasons) bloodletting. Blood, the source of life, emanates from the chyle. Brahmans and princes belong to a caste whose blood must not be drawn. In luetic affections blood was taken from the genitals. The lancet was the only instrument employed in bloodletting. Obstinate hemorrhages were treated with the red-hot iron, by compression, and with caustics and astringents. Cylinders, closed at the upper end with linen, were used as cups. After scarification the blood was drawn by means of these cylinders. The lancets were made of steel and had a very keen edge. In other parts of Asia, particularly in Bengal, leeches were employed since the earliest times.

We have now reached the classic period. Venesection was practiced but rarely by the early Greeks and Romans. Among the case histories of the compilation



“Epidemia” only one case is recorded in which artificial bloodletting was resorted to. This was a case of pneumonia, which recovered on the thirty-fourth day. It was *Hippocrates*, who was born about 460 B.C., to whom the general introduction of bloodletting as a prophylactic as well as a remedy should be ascribed. It was this great physician who put forth the following indications for bloodletting: Engorged hypochondria in case the swelling is not the consequence of meteorism; orthopnea without expectoration when the impeded respiration is not caused by a discharge of pus into the pleural sac and subsequent pulmonary compression, but when it is due to air-hunger; violent pains in the regions of the liver and spleen; inflammations and pains above the diaphragm. “All this,” says Hippocrates, “is not dispelled unless evacuation is first procured. Bloodletting is here the most important remedy.” It is evident that he also abstracted blood for curative or hygienic purposes in a purely empirical manner. He had observed that artificial depletion gave relief in respiratory embarrassment; but notwithstanding his keen sense of observation, he did not recognize the causative factor of the pulmonary difficulty—the retarded gas interchanges in the lungs—and he could not explain why improvement ensues after bloodletting. We know, of course, that it is the relief of the heart’s work which is afforded by the abstraction of blood. If the most renowned physician of ancient times was unable to comprehend such simple processes, how vague must have been the ideas of the ordinary medical man!

Hippocrates’ instruction that the patient should eat and drink and raise his temperature by exercising before his blood is withdrawn obviously applies in the main to chronic cases. As a rule, the operation was

performed on the arm, but when local inflammation and pains were to be treated, also on other parts of the body supposed to be in relation with the affected organ, for instance, on the foot, on the veins of the tongue, etc. Hippocrates recommended the use of a bandage to secure venous engorgement; it should, however, not be applied too tightly, so that the circulation would not be interfered with. Furthermore, care should be exercised that the wounds in the skin and vein corresponded. The operation, it is advised, should be performed by means of a curved bistoury of medium width. The amount of blood to be withdrawn depended on the season of the year, the constitution and age of the patient, and also on the color of the blood. In pneumonia the blood should flow either until it became bright red, or if bright red at the start, until it attained a darker tint. The same rule applied to pleurisy. As far as therapeutic and not prophylactic bloodletting is concerned, it appears that the school of Hippocrates insisted upon withdrawing considerable quantities of blood. If the pleuritic pain was very severe, blood was removed until the patient fainted. One case is reported in which the operation was repeatedly performed on both arms so that anemia would ensue, and recovery is said to have been achieved. *Häser*, however, opines that this passage in the *Corpus Hippocraticum* may be unauthentic.

If after the removal of the bandage there occurred a severe hemorrhage (possibly caused by an injury to one of the larger arteries), the wound was covered with compresses steeped in wine, while the extremity was bent inward at the elbow or knee and kept fixed in this position. Prophylactic bloodletting was undertaken in the spring of the year only. Scarification by means of the lancet and cupping was known long before the time

of Hippocrates. At first the points of horns, the cupping apparatus of the Egyptians, were used in the Greco-Roman world; at a later period cups were made of metal, and after the air was sucked out the opening at the top was closed with the finger or with wax. Leeches are mentioned by Hippocrates only in connection with the impurities of the drinking water; it appears that he has never made use of them in the abstraction of blood.

Although Hippocrates possessed a very meager knowledge of the physiological, pathological and therapeutical processes upon which the beneficial effects of bloodletting are based, he certainly was most thoroughly versed in the art of venesection. There is no reason to doubt that the cases of pleurisy, pneumonia and peritonitis, angina, uremic convulsions, etc., cited by him were really cured, or at any rate improved, by timely bloodletting. The technique employed by him is in its essential parts about the same as that used by the modern operator. To be sure, his method of subduing pain by producing cerebral anemia and subsequent syncope is a rather heroic and questionable one. However, no other means were at his disposal to induce anesthesia. In spite of many faulty views entertained by this ancient physician, it must be freely acknowledged that he has often instinctively adopted and followed the proper course.

One hundred years after Hippocrates, *Crysippus of Knidos* took a firm stand against venesection, but the practice had become so popular that his strenuous efforts to abolish it were of little avail. After a few flagrant abuses in connection with bloodletting had been discontinued, it became again a favorite remedy for many ills at the time of *Celsus*. *Galen* devoted much attention to the study of this subject, and gave detailed

instruction as to the technique of the procedure in one of his treatises. He himself practiced bloodletting frequently, and fervently advocated its use. His teachings, including those concerning the artificial withdrawal of blood for therapeutic reasons, were looked upon as authoritative by the profession for many centuries.

*Paulus of Ægina*, at a later period, suggested some improvements in the theory and practice of bloodletting. He employed cupping for revulsive purposes only. When he noted symptoms of inflammation in one part of the body, he applied the cups over another part, in order to produce a counter-irritation and thus draw off the morbid condition. Cups made of glass he considered to be too fragile. He constructed metal cups with long necks and wide bells, in order that the air in them could be the better rarefied by heat. For scarifying purposes he used a bistoury, instead of the triple-bladed knife, which was the customary instrument of his immediate successors. He preferred to make oblique incisions in the bend of the elbow. In robust persons, as a rule, the required quantity of blood ought to be withdrawn at one sitting, even though syncope should ensue; in feeble persons and children he recommended to make several small abstractions. From individuals above sixty years and children below fourteen years of age blood should only be drawn in case of real necessity. The quality of the pulse was his guide in deciding the question whether or not a sufficient amount of blood had been withdrawn. He upheld no rule as to the time when the operation should be performed, in order to avoid a period of exacerbation.

He gave special instructions how to perform the operation on the frontal and on the external jugular

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vein. The old rule to let the blood flow until it became light-red he modified with the direction that the operator should be guided solely by the pulse. For the arrest of an eventual hemorrhage he recommended the application of ligatures. Celsus and Galen, however, had already tied the blood vessels in instances of continued bleeding. Paulus of Ægina gave a new indication for the employment of bloodletting by advocating it for the removal of renal calculi. It was his belief that the abstraction of blood would so relax the ureters and bladder that a kidney stone would be dislodged and expelled.

In closing this chapter it should be mentioned that bloodletting was resorted to by the Ancients for other than medical purposes. *Aulus Gellius*, in his work "Noctes Atticæ," remarks that venesection was imposed upon the warriors as an ignominious punishment for cowardice. This was intended to forcibly impress upon the military man the weight of his duty ever to be ready to shed his blood for his country. Other commentators suggest that venesection took the place of the death penalty for minor disgraceful military offenses. In the ancient days blood was highly valued as the source of life and strength, and its forcible removal from the body was expected to make the delinquent soldier feel the enormity of his guilt the more intensely.

*Friedländer* makes the interesting remark that the less educated physicians in Rome were always most particular in making a lavish display of ivory boxes, silver cupping utensils and surgical knives with gilt handles. Examinations for a medical license were not required in those days, and the responsibility of the physician was rather limited. In consequence many unqualified men from the lower classes forced their



way into the profession of healing, which became a very lucrative business if its proprietor was clever and skilful. Cobblers, carpenters, dyers and blacksmiths frequently gave up their trade and performed blood-letting and other medical functions. The display of instruments was calculated to impress the patient with the learnedness of their owner, and in a measure hypnotized him. Worthy of mention also is the fact that certain medicaments were used by the Roman practitioners which depleted the body of blood and thus caused death. A man from Byzantium is said to have discovered by chance an herb which had this effect on the body. When brought into court he said that a pig's liver had fallen upon this plant and when he removed it he saw a number of drops of blood rolling over the leaves. He had then experimented on the human body with the herb and found that it produced severe hemorrhages. By its aid he had killed a number of persons; even when tortured he denied that he had ever shown the plant to any one else. He claimed it grew everywhere. The governor, therefore, ordered him to be blindfolded, thus to prevent him from pointing it out to others whilst on his way to the gallows.

### C. The Middle Ages and *Medicina Astrologica*

The historical fragments of ancient literature at our command give us only glimpses into the development of phlebotomy. So far as the oriental peoples are concerned, our knowledge about the practices of blood-letting is so limited that the historian is compelled to often substitute mere surmise for facts. The Middle Ages offer more fruitful sources for investigation and a comparatively large literature on the subject of bloodletting, especially since, through the invention of printing, the exchange of thought and the dissemina-

tion of knowledge among savants as well as laymen was infinitely facilitated. From the earlier periods of the Middle Ages only manuscripts are at our disposal, and there is always the danger that in transcription unwarranted omissions or additions, in other words, unauthorized changes, may have crept in. It is, of course, not my object to deal with every phase of the development of venesection in the Middle Ages, to enter into all the details, or give an exhaustive history of the art. I shall only touch upon such historical data affecting medicine and civilization in general as are characteristic of the trend of thought prevailing in the Middle Ages and which determined in a decisive manner the development of venesection.

It was *Lombroso* who coined the word "Misoneism," in order to designate the propensity innate in man to combat new ideas. The remarkably tenacious vitality of venesection is undoubtedly due in great measure to misoneism. Artificial bloodletting had become a popular practice, its advantages and beneficent effects in many pathological conditions were manifest, and in consequence the people were loath to renounce it in favor of some new ideas. Innovations are usually not readily grasped and accepted by the majority of mankind. Their practicable application must be proved beyond doubt before they can replace established customs and long-formed habits. Misoneism is really nothing else but that universal property of matter, as applied to the human brain, which asserts that "every body perseveres in its state of rest or of uniform motion in a straight line, except in so far as it is compelled by force to alter that state." The charges against bloodletting of necessity were unheeded because nothing better could be offered in its stead. Thus it was always, and thus it will always be.



The beginning of the Middle Ages is about synchronous with the advent of Mohammedism. With this a new psychical and intellectual force wedged itself between the old peoples. Theoretically speaking, Mohammedism could hardly be expected to uplift the art of healing, for the "truths" or principles laid down in the Koran automatically stifled any attempt at independent research. The same might also be said about the Talmud. And yet many famous and prominent medical men were Jews or Arab confessors of the Koran. So far as phlebotomy is concerned, I have been able to trace in the literature but four Arabian physicians who were known to be believers in and diligent practicers of this art. Their names were *Avicenna*, *Abulkasem* and *Rhazes*, and the Moorish Jew *Maimonides*, physician, philosopher and poet. Rhazes recommends venesection particularly as a febrifuge in smallpox. On the whole, however, the Arabian physicians were satisfied with exploiting the doctrines of Hippocrates, Galen, Paul of Ægina and other Greek authorities for the benefit of the Mohammedan world and the Moorish Jewry, without, however, achieving any remarkable or independent observations or improvements in this domain.

In the earlier days of the Christian Middle Ages artificial bloodletting was principally performed by the monks. Even among themselves they practiced it at certain seasons of the year. *Strubell* is of the opinion that this was done to render the observances of the vow of chastity easier, because the loss of blood produced transitory lassitude and impotentia cœundi. Others do not share this view. *Häser*, for instance, maintains that in all probability the monks, being children of their time, simply followed the common practice of the

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period when everybody firmly believed in the efficacy of bloodletting.

Gradually that sharp distinction was established between medicine and surgery which seems so inconsistent to our modern way of thinking. Medicine, influenced by the scholastic teachings, degenerated more and more into natural-philosophical speculations. The performance of any surgical operation, however trifling, was looked upon by the learned physician as a degrading act unworthy of his professional standing. Surgery was peremptorily removed from the curriculum of the medieval universities. In this manner, venesection was taken out of the hands of the physicians, despite the fact that it was still considered useful and even necessary in certain cases, and it became a distinct and important part of the occupation of the barbers, who exploited it indiscriminately and in a business fashion. After Pope Boniface VIII had enjoined the monks from practicing venesection, the barbers had virtually a monopoly of the trade of bleeding.\*

An unequalled vampirism soon became rampant. On Sundays the country folk would stream into the towns in order to have the superfluous blood drawn off. In addition to the bloodletting, strong purges were usually given. The physicians still continued to order artificial bleeding, although they refused to perform it themselves. They left it to the barber, who also set bones, dressed wounds and did all kinds of "base" surgical work. Venesection itself had, therefore, not

\*Thiele remarks that Boniface VIII based his edict on the dogma "*Ecclesia non sitit sanguinem.*" But this is an error. The principle, the church does not thirst for blood, related to the execution of the death penalty pronounced by ecclesiastical courts. In consequence the actual performance of capital punishment of heretics, witches, etc., reverted to the civil authorities. Monks and the clergy at large were prohibited from performing venesection merely on the ground that surgical operations were deemed unseemly occupations for learned men.

fallen into disgrace, only its performance by the physician. There was scarcely a disease which was not considered to be amenable to treatment by lancet and the cupping glass.\*

This excess, of course, was bound to be followed by a reaction. The most prominent physicians raised their voices against phlebotomy. But they made the mistake of spilling the child with the bath, i.e., they sought to abolish venesection altogether. They declaimed not only against the excess and indiscriminate use of, but against phlebotomy itself. They failed in putting the ban upon a fashionable operation. The importance of venesection rose and sank with every new theory or hypothesis of the nature of disease. Everlasting disputes arose among the physicians, who, dominated by the then prevailing humoral pathology, often entertained the most fanciful ideas about the blood and its physiological functions. The people at large took no interest in these disputes, unless they extended into the realm of religion, which was particularly the case in the times when the *medicina astrologica* prevailed.

Astrology, alchemy, magic and all the peculiar ideas of secret natural forces so dominant at the close of the Middle Ages should be adjudged either from the standpoint of the schooled medical man or from that of the layman of those days. The truly educated physicians never coupled these occult sciences with preter- or supernatural forces. No matter how bizarre their ideas of etiology, pathology and therapy appear in the light of modern science, it must be admitted that they never ascribed the influence exercised by the stars upon the

\*Of historical interest is the law of *Visigoth*, enacted about 550 A.D., which forbade the physician to be alone with a woman who came to be bled. The operation was always to be performed in the presence of her relatives.

health and welfare of the human body to any but purely natural causes. They looked upon the stellar influence as an established and indisputable fact, just as we assume as a fact that ebb and tide, the periodical rising and falling of the sea, are the result of the attraction between sun and moon.

It was different with the majority of the population. The astrological teachings of *Tycho de Brahe*, *Kepler* and others, based upon false premises and erroneous observations of nature, were entirely misinterpreted by the common people, who construed systems of mysticism from them. The astrology of the ancient Chaldæans was revived and melted together with the Christian idea of divine Providence which directs the fate of man into the belief that God makes known his intentions unto mankind by the course and constellations of the sidereal bodies. Yet, as *Magnus* rightly charges, the medical profession is not entirely free from the imputation that it yielded too readily to astrological superstition, did not take a sufficiently energetic stand against it, and for the sake of the daily bread denied their own convictions. They were afraid, if they spake the truth, of incurring the ill will of their patients and thus impair their own income. Silence, therefore, was golden, and the people were welcome to their superstition.

It has already been mentioned that throughout classical Antiquity medicine was in many ways associated with magic and astrology. Everywhere the belief prevailed that the whole of nature was dominated by antipathetic and sympathetic forces. Even *Pliny*, who was an exceptionally enlightened man, believed in it and called it "the antagonisms and friendships of the mute and unconscious things." *Galen* also was convinced that the lunar week exercised the greatest possible in-

fluence upon all things terrestrial and that the position of the moon to the good and evil planets produced the so-called "critical" days for the sick as well as for the healthy, of which the old Egyptian astrologers had already spoken and which were of pronounced importance in the performance of medical functions, especially of venesection.

Even at the close of the enlightened eighteenth century this superstition still prevailed. Quite recently a Greek manuscript, which was the subject of a lively discussion, was read before a meeting of the French Society for Medico-Historical Research. The manuscript dates back to the year 1785 and gives accurate indications for each day of the month whether the constellation of the stars is favorable to bloodletting or not.\*

\*We note here the days of the moon on which bloodletting is indicated or contraindicated:

The 1st day is not good, for if blood is let on this day the face will be yellow all the year round.

The 2nd day is not good, because dropsy will follow in the wake.

The 3rd is not good, because it will bring trouble for the rest of the year.

The 4th is not good, because it will cause sudden death.

The 5th is good, because it separates blood and water.

The 6th is good, because it separates milk and water.

The 7th is good, because it allays the stomach.

The 8th is not good, because it will cause heat and headache.

The 9th is not good, because it will lead to leprosy.

The 10th is not good, because it makes the face sore and the mind indifferent.

The 11th is good, because it strengthens the body.

The 12th is good, because even little nourishment will make fat.

The 13th is not good, since it will cause loss of appetite, vertigo and sickness.

The 14th is not good, because it will engender leprosy.

The 15th is good: no fear of death.

The 16th is good, because it will improve the affection.

The 17th is good, because it will improve the condition of the body (it will make the body hale and hearty).

The 18th is good, because no evil consequence will result from it.

The 19th is bad for each and every reason.

The 20th is good, because it increases the appetite and gives health.

The 21st is good on all counts.

The 22nd is good for the arms.

The 23rd is good, because it will remove the bile.

The 24th is good, because it strengthens the mind.



There is no doubt that many physicians, especially those without scientific training, were infected by the common superstition and with full conviction determined with the aid of astrology the indications and contraindications for a successful venesection. Yet there must have been a large number of sceptics who secretly smiled at the hocus-pocus, but in an unscrupulous fashion exploited this astrological superstition for their own gain.

The "Planet Book" by *Andreas Remus* shows how the physicians in their helpless and destitute condition were forced to submit to the ignorance of the people. In this treatise, whilst it contains much that deals with the "natural" astrology and the indications for venesection governed by the constellation of the celestial bodies, the author persistently reduced the therapeutic effects of bloodletting to the direct interference of the deity. He attempts to show "how every one can learn his good and evil fortune and much else that may prove useful and of service during one's lifetime with the aid of a good friend who loves this art and from his great Planet Book newly revised and enlarged with many canons." The book is nearly all written in rhymes. I briefly quote after Urban a few lines from the concluding chapter:

"Also hastu gut Leser frum  
Genugsam g'hört in einer Sum,  
Wie du dein Leben sollst stellen an,  
So du wilst ein langes Alter han,  
Nach maynung der Alten sitten,

The 25th is good, because it refreshes the memory.

The 26th is bad for each and every reason.

The 27th is bad on account of sudden death.

The 28th is bad, because there is danger of death.

The 29th is bad on account of everything.

Count the lunar days with the days of the calendar month in order to make them agree.

Darzu sie aber keinen bitten,  
Sonder zu gut ein jeden Freundt  
In trewen solchs haben gemaynt,  
Damit mass werd gehalten fest,  
In allen Dingen, das war das best,  
Hie auf Erden in diserzeit,  
Im leyd so wol als in der Frewd,  
Vor allem solst ohn sonder laugen,  
Gott halten stets vor deinen Augen,  
Der kan vnd mag dir allweg geben  
Gesundheit, wolfahrt, langes leben.  
Zu Seel vnd leib dir solches gedey,  
Mit Himlischer gnad dich auch erfrew.  
Das wünscht dir ohn Hindernuss  
Von Straubingen Andre Remus.”

The *medicina astrologica* has exerted an immense influence upon bloodletting. *Leopardus Botallus*, the body physician of King Henri III of France, claimed that under the proper constellation pneumonia could be “strangled” by means of phlebotomy. Children also, even nurslings, who cannot, as a rule, tolerate well any loss of blood, were subjected to the procedure if the astrological indications proved favorable.\*

In case the infants succumbed, the failure of bloodletting to save their lives was attributed to the neglect of the rule of the Chaldæan astrologers that the human body must not be touched with iron when there are present certain astronomical constellations. As venesection was deemed an absolutely essential remedy, a regular system of bloodletting based upon star-maps was worked out. The relations that exist between the various parts of the human body and the signs of the zodiac were defined with the utmost precision. This made it easy to determine by which especial influence of the heavenly bodies the vitality of each single mem-

\*That venesection will benefit children in well-defined clinical conditions is shown in the chapter “Bloodletting in Children.”



ber or organ of the anatomy was controlled. Every vein that could possibly be reached by the lancet was made to correspond with some star. In order to facilitate the difficult art, so called, "Venesection Manikins" were constructed, upon which all the numerous points suitable for venesection were carefully marked.

The *medicina astrologica* proved a *prima facie* and convenient aid in making a diagnosis. Since the sun, moon, planets and the signs of the zodiac had each a special share in the control over the various organs of the body, the physician had little need to examine his patient in order to localize the disease or ascertain its cause. A single glance at the position of the stars sufficed to tell him which particular organ of the body was just then imperiled by the celestial constellation. For instance, if the patient complained of indigestion the stellar map was consulted. If something unusual was observed in the position of a certain star, the organ under the especial influence of this star was ascertained. If it happened to be the liver, then the liver alone and no other organ was responsible for the disturbance and the diagnosis was settled.

However, not only the diagnosis, but also the treatment and the indications for venesection could be learned from the stellar map and its corresponding venesection manikin. As is evinced from the accompanying figure, there were not less than fifty-three different venesection possibilities. And as each of these possibilities furnished four or five or even more indications, the number of potential bloodlettings ran into the hundreds. Perplexing as it was to find one's way in the labyrinth of this therapeutical problem, the difficulties were further increased in that the *medicina astrologica* distinguished also between favorable, doubtful and unfavorable venesection days. This de-



FIG. 1

Venesection Manikin from Stöckler's *Calendarium romanum magnum*. Published at Oppenheim-on-the-Rhine, 1518. Fol. 14.

## EXPLANATION

A. The astronomic symbols printed upon the various parts of the body indicate the stars in the zodiac by which they were supposed to be especially influenced or controlled.

B. The numbers found upon the various parts and organs refer to the indications of bloodletting, as given in the following. In the designated locations blood should be abstracted in:

1. Pains in the eyes and the head; affections of the face, including erup-

tions. 2, Diseases of the head; mental disturbances. 3, Eye diseases of every kind. 4 and 5, Pain in the ears; watery eyes. 6 and 7, Tingling in the ears; tremor of the head. 8, Disturbances of hearing. 9, Heaviness of the head; weeping eyes. Bleeding in this location also strengthens the memory and the activity of the brain. 10, Heaviness of the head. 11, Ulcers of lips and gums. 12, The veins of the palate should be beaten when there are eruptions in the face, in toothache and affections of the palate and mouth; heaviness of the head. 13, Rheum and toothache. 14, Headache; mental disorders. 15, To improve the memory. 16, All affections of the mouth and chest. 17, Bad breath. 18, Pain in the jaws; fetid odor from the nose; facial eczema. 19, Rheum in the head; eczema. 20, Chest affections of every kind. 21, Rheum in the eye; headache; epilepsy. 22, Affections of the chest, including shortness of breath; headache; stitch in the side. 23, Diseases of the liver; injuries of the right half of the body; nose bleeding. 24, Affections of the head and eyes; pains in the shoulder blades; rhinitis. 25, Cardiac pains; pleuritic pains; oral pains. 26, Cramps in the fingers; pain in the spleen; pains in the joints; nose bleeding; stitches in the liver. 27, Pains in the central portion of the abdomen. 28, Affections in the lower portion of the abdomen. 29, Heart diseases. 30, To strengthen the eyes and increase body agility. 31, Headache; fever; cataracts; corneal affections; inflammations of the tongue and trachea. 32, Pains in the head, lungs and spleen. 33, Blood diseases; chlorosis; jaundice; diseases of the head; stitch in the right side. Bleeding in this location purifies the liver, spleen and chest. 34, Like 31. 35, Like 32. 36, Diseases of the spleen; meningitis; hemorrhoids; stitch in the left side; kidney affections; dysmenorrhea. 37, Affections of the spleen and bladder. 38, Dropsy; digestive disturbances; indolent ulcers. 39, Melancholia; bloodletting in this location invigorates the kidneys. 40, Hemorrhoids; stranguria; digestive disorders; affections of the bladder and genital organs. 41, Bloodletting in this location exerts a salutary influence upon the organism in general. 42, Affections of the kidneys and bladder, including urinary calculus; diseases of the testicles. 43, Bloodletting in this location improves walking. 44, All kinds of pains in the lower extremities, as arthritis and podagra; dysmenorrhea. 45, Affections of the genital organs; diseases of the kidneys and bladder. 46, Affections of the testicles. 47, Menstrual disorders; sterility of women; affections of the bladder and spleen. 48, All kind of affections of the feet. 49, Dysmenorrhea; eruptions in the face and on the legs. 50, Apoplexy; paralysis. 51, Ophthalmia; affections of the skin; cough; oppression in the chest. 52, Dysmenorrhea; affections of the testicles; pain in the ribs. 53, Ophthalmia; dysmenorrhea; amenorrhea; skin affections.

cision was based upon certain conditions prevailing between the sun and the moon and the planets. If a planet, for instance, stood in an unfavorable sign, or if there was something wrong in the relation of the signs of the zodiac to the sun or the moon, those organs which were controlled by that particular star were to be the sufferers. The different hours of the day or night were likewise supposed to have a distinct influence upon the humors of the body. And, again, there was a different venesection day for every period of man's life. Days which were considered favorable for the blushing youth were disastrous to the aged. Then there were the "critical years" (the climacteric periods), which were at yearly periods divisible by seven or nine, e.g., 21, 35, 49, 63, 77, etc. The most dangerous age was the sixty-third or eighty-first year,

the grand climacteric, on account of  $7 \times 9$  or  $9 \times 9$ , respectively. In these "critical years" particular care was exercised in consulting the stellar map and the venesection manikin in order to forego any possible error as regards the abstraction of blood.

In the foregoing illustration, which was originally published by *Stoeffler* in his "Calendarium romanum magnum" in the year 1518, the numbers indicate the locations where in certain diseases venesection should be undertaken. Each sign of the zodiac, on the other hand, designates and is printed upon that organ or part of the body which, it was claimed, it controlled. It is worthy of special mention that each vein was supposed to have a particular function to perform, and also that results obtained by venesection performed on the right side of the body differed from those following the same procedure on the left side.

This was the character of the *medicina astrologica* which weighed like a nightmare upon the human race for hundreds, nay thousands, of years. This medical superstition, with its wanton waste of human blood and its other therapeutical monstrosities, has killed more people than the bloodiest of wars ever did. If the ancient world, steeped as it was in every kind of superstition, had nursed and fostered astrology, this started upon its world-conquering career during the thirteenth century. At this period, a real furor astrologicus obsessed the ignorant people as well as the men of science. This movement started from the Court of Emperor Frederick II. This great Hohenstaufe was such an enthusiastic zealot in all matters appertaining to astrology that he never attempted to enter upon any undertaking until he had learned what the stars had to say about it. The interests of the *medicina astrologica* were further advanced by the circumstance that



soon after the death of the emperor two eminent physicians, Arnald of Villanova (1235-1312) and Petrus of Apono (1250-1315), sold themselves body and soul to astrology. This erratic course taken by medicine was so deeply rooted in the people that even in the eighteenth and nineteenth centuries certain days of the year were deemed to be particularly auspicious for bloodletting. In the almanacs these special days were carefully marked.



FIG. 2

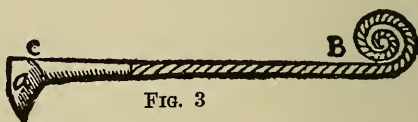


FIG. 3



FIG. 4

Old Instruments for Bloodletting

At most of the European courts astrology was in vogue from the thirteenth to the seventeenth centuries and the *medicina astrologica* held unrestricted sway. Besides Frederick II, may be mentioned the royal court of Aragon at Palermo, Alfonsus X of Castile, the electors Joachim I of Brandenburg and Albrecht of Mayence, William, landgrave of Hesse, duke Albrecht of Prussia, the German emperor Charles V and others. All these princes were disciples of astrology as well as of the *medicina astrologica*. *Thomas Erastus*, the well-known opponent of Paracelsus, relates that as physician to the reigning Count of Henneberg he was not allowed to prescribe any medicine or to attempt venesection without first consulting the stars. Under

Frederick II of Denmark, the court of Copenhagen was the center of the astrological cult, where no less an authority than Tycho de Brahe put his best efforts into its advancement. Astrology, however, was not only cultivated by the rulers, but illustrious savants, statesmen, military leaders and natural philosophers and others put their faith in it. Melanchthon, for instance, being a staunch believer in it, espoused its cause in speech and writing. *Magnus* recalls that this great associate of Luther was not for a moment in doubt as to the outcome of his last illness because Mars and Saturn were in conjunction. It is generally known that Wallenstein, the great generalissimo of the Catholic party in the Thirty Years' War, had also been an adherent of astrology and its satellite, the *medicina astrologica*.

Yet the Middle Ages, especially the transition period of the sixteenth and seventeenth centuries, produced also medical men who, although believers in venesection, did not subordinate it to the astral constellations and were strong opponents to the *medicina astrologica*. The most defiant among them was *Paracelsus*, whose revolutionary mind was averse to almost every medical and biological doctrine entertained by the professional sages of his own time.

When we realize that, in accordance with the teachings of the *medicina astrologica*, bloodletting was not preceded by a medical examination, but merely governed by the constellations of the stars, and that consequently venesection was practiced on "favorable days" even though no therapeutic reasons for it were present, it is clear that this "hematomania" was bound to meet with opposition sooner or later. Of course, there were also men during this dark period in the history of medicine who on principle rejected not only astrological medicine, but also venesection upon the

whole; however, they did not dare to denounce them openly. But a few had the courage to swim against the current, as, for instance, the learned Count *Pico of Mirandola* (1483-1553). *Pierre Brissot* (1478-1522) was one of the more advanced physicians of his time, who did not entirely disapprove of venesection, but strenuously combated the insane waste of blood. *Van Helmont* (1577-1644), who insisted on conserving the blood, and his contemporary *Francis de la Boë*, who wanted the blood diluted by tea-drinking, condemned venesection altogether. Their labors were in vain. The time for reform had not yet arrived.

#### D. From Harvey to Dyes

The modern development of phlebotomy commences with the discovery of the circulation of the blood by *William Harvey* (1578-1657). It is gratifying to note that the many attempts to rob this famous Englishman of the honor of this momentous discovery have met with failure. Yet one cannot help to admit that the first step toward this discovery was made by the unfortunate *Michael Servetus*, who was burned at the stake in Geneva by Calvin on account of an alleged heresy regarding the Trinity. Servetus advanced the important tenet, that the part of the blood intended for the preparation of the "spiritus vitalis" does not pass from the right heart through the septum into the left ventricle, but by a tortuous route finds its way through the arteria pulmonalis into the lungs, where it combines with the inspired air, and in this form reaches the pulmonary veins and the left heart. Among the reasons for his view Servetus called particular attention to the size of the pulmonary arteries as being much too large for vessels merely carrying nutrition. A few years later *Colombo*, a pupil of



Vesalius, arrived at the same conclusion, although he was ignorant of Servetus' findings.

*Harvey's* discovery was much more conclusive than the attempts of Servetus and Colombo. This, however, is not the place for entering into details which, after all, are the common property of the educated classes. I only wish to mention that Harvey laid particular stress on the pith of his doctrine, i.e., the proof that the whole of the blood flows through the heart in a given time and passes from the ends of the arteries through porosities of the tissue into the radicles of the veins, and that the valves of the veins in like manner as the cardiac valves serve to prevent the return of the blood from the greater venous stems into the smaller branches, and to aid its centripetal movement.

It is evident that this discovery must have been of the utmost import to every branch of medicine, and particularly so to venesection. Reluctantly, however, I must admit that the beneficial effects of this discovery were only recognized in their entirety some two hundred years later. Had Harvey's epoch-making findings been at once accepted by the scientific world, most radical reforms in physiology, pathology and therapy would have promptly followed. But the repeatedly alluded to "misoneism" again triumphed. Harvey encountered at first a bitter opposition. Even his own countryman *Primirose* entered the ranks against him. Recognition came only at a later period, and even then it was a very long time before the right conclusions were drawn from the new doctrine. The old methods of venesection still persevered.

The only progress worthy of record is the fact that the sway of the *medicina astrologica* gradually faded away, although the superstition survived for a long period among the common people. The physicians, at

any rate, no longer consulted the stars. The "venesection manikin" was relegated to oblivion. *Sydenham* (1624-1689) based his diagnosis upon the findings at the sick-bed and examined his patients thoroughly before he entered upon venesection. If the patient was frail, he eschewed venesection, employing in its stead enemas, whey-diet, etc.

At the turning period of the sixteenth into the seventeenth century we find three of the most prominent physicians adherents of the practice of venesection. *Ernst Stahl* (1660-1734) maintained that in febrile states nature endeavored to rid itself of the superfluous blood, and that bloodletting is nothing else but an artificial procedure to assist the natural curative tendency. Stahl was the first to emphasize the fact that superabundant perspiration followed venesection. *Friedrich Hoffmann* (1660-1742) recognized the therapeutic and prophylactic value of bloodletting, but called it "a sword in the hands of a maniac when employed out of season." He recommended that plethoric persons be bled twice every year. Withal he was of the opinion that abstemiousness and physical exercise rendered bloodletting unnecessary. *Boerhaave* (1668-1738), the most renowned physician of the eighteenth century, was a most enthusiastic defender of venesection. Of him it was sarcastically said: "Plures occipit lanceola quam lancea." (He killed more people with the lancet than with the lance.) Whilst Sydenham and the aforementioned luminaries of medicine were, after all, conscientious in following the indications and contraindications prescribed by contemporaneous science, the French physicians of the eighteenth and at the beginning of the nineteenth centuries abused bloodletting to such an extraordinary extent that the Hotel-Dieu became a veritable "bureau de saignée." Antiphlogistic treatment

at any price was the cry in those days. The sick were treated at this great hospital alternately with purgatives and bloodletting. Ten and even twelve venesections were the rule; some patients were bled even twenty and thirty times. In one case four pounds of blood were withdrawn, in spite of fainting and convulsions. In these acts of vampirism *Broussais* (1772-1838) and his pupils were the leaders; they held that fever was due to an inflammation of the endocardium and of the tunica intima of the blood vessels. Even patients affected with pulmonary tuberculosis were not exempt by Broussais and his followers, as has been shown by *Piéry* and *Roshem* in a historical treatise on phthisiotherapy in the nineteenth century. It was presumed that the causes of the inflammatory processes were removed by bloodletting. To be sure, this procedure proved so effective in many instances that the consumptives were no longer in need of doctor or bloodletting.

In vain did *Bordu* in France, and *Wolstein* and *Metzler* in Germany, raise a warning voice against this unwarranted shedding of blood. Even the leading authorities at the old Vienna school, such as *Van Swieten*, *Anton de Haen* and *Stoll*, were so firmly convinced of the practical value of venesection that the most striking and potent arguments advanced by their opponents against its use were unable to shake their faith. Brownianism effected only a transient abatement in this hematomania. *John Brown*, as is well known, divided the diseases into sthenic and asthenic affections, but most of them he categorized as belonging to the asthenic variety. He based his system upon the opinion that the animate bodies are distinguished from the inanimate by their sensitiveness to "stimulation." The stimuli are either external or internal. Blood,

mental activity, etc., belong to the internal. Deficiency of stimulation produces "sthenia," excess "asthenia." Now, inasmuch as, according to Brown, loss of blood decreased stimulation, and most diseases were founded in asthenic conditions, he had to be, as a matter of course, an opponent of venesection. He had many followers, who like him discountenanced bloodletting. However, this moderation was not to last any length of time. Stoll's doctrine, that most diseases were caused by inflammatory processes which must be removed by energetic bloodletting, triumphed over Brown's theory. Blood began to flow again in streams and many physicians gloried, as *Krüger* says, like generals, in the boast of having spilled more blood than any other. It is said that a female patient suffering from convulsions, who was then in the Civic Hospital of Prague, was bled eight hundred times.

Observations made by Sauvier in the battle of Solferino, recently communicated by *Perrin*, evince that bloodletting renders efficient service not only in conditions like pulmonary edema, uremia, eclampsia, etc., but also in obstinate hemorrhages of penetrating wounds of the chest, incurred by bullets or bayonets. Hemoptysis was arrested, and pulse and respiration improved after the withdrawal of blood. Though there ensued transitory aggravation in some cases, they all were finally cured. Blood abstraction was performed from six to ten times, and on each occasion from 300 to 500 c.c. blood was withdrawn.

*Hufeland* threw his whole authority into the fight for limiting the use of venesection. He held its value in high esteem, but called it not only the greatest, but also the most dangerous of remedies. In his "Encheiridion medicum" (1839) he gives the following indications for its use: (1) Antiphlogisticum in all in-

flammatory and febrile conditions; (2) Deplethoric agent for decreasing excess of blood; (3) Revulsive for removing congestions and diverting a blood stasis from vital organs; (4) Nerve sedative in all violent reactions of the nervous system. This included cerebral anemia and syncope superinduced by bloodletting, which served a good purpose in painful surgical operations partly as a relaxant and partly as an anesthetic; (5) Prophylactic for the prevention of apoplexy. In feeble and nervous individuals venesection was, according to Hufeland, contraindicated. He substituted in such cases mercury, quinine, tartar emetic and other medicaments.

Hufeland's timely warning can only be appreciated when one recalls the enormous wasting of blood which, especially under the influence of the French school, still prevailed in the third decade of the nineteenth century. The dangers of this excessive practice had become so apparent in countless cases that his warning voice found ready listeners. Not that bloodletting was now entirely abandoned. Its employment in pneumonia was deemed of such paramount importance that a surgeon who had omitted it in a fatal case of that malady was, after Clarus, professor of internal medicine in Leipsic, had expressed his authoritative opinion, to be prosecuted for murder.

With the development of pathological anatomy and of physiology in the forties of the last century, a violent controversy arose about the pros and cons of bloodletting, which ended in such a complete victory for its opponents that at the end of the century it had fallen into innocuous desuetude. Old country doctors still practiced it, because among the common people it had not yet lost its popularity. Academic strifes, as a rule, do not reach the hearts of the people. But at



the clinics of the universities and in the large hospitals bloodletting was ostracised and proscribed for many a long year.

With the advent of sulphuric ether (1846) and of chloroform (1847), bloodletting was entirely abandoned as a general anesthetic. Then came *Virchow*, who put an end to the dispute started by *Wunderlich* over the significance of the increase of fibrin formation in inflammation. *Wunderlich* contended that the hyperinosis, i.e., the abnormal increase in the fibrin-factors in the blood, must be regarded the most essential circumstance in the inflammatory process, and that, therefore, therapy should be directed toward the decrease of fibrin by means of bloodletting. *Virchow* proved that the increase of fibrin in inflammation was of subordinate significance only, and that, therefore, the removal of fibrin from the blood was not essential for a cure.

The esteem in which venesection had been held faded away still more when homeopathy and the *Priessnitz* system of hydrotherapy demonstrated that pneumonia and other inflammatory diseases could be relieved and cured without resorting to artificial bloodletting. In the meantime *Wunderlich* had made fruitless attempts to prove from the statistics of the medical clinic in *Leipsic* that the death rate in pneumonia was twice as large among the cases in which the blood had been conserved than where a certain amount of blood had been lost either spontaneously (through nose bleeding or some accidental injury) or through artificial interference.

*Wunderlich* was the only one among his great contemporaries who clung with tenacity to the old doctrine, while the leaders of the new *Vienna* school, contrary to those of the old, like *Skoda*, *Dietl* and *Op-*

*polzer*, condemned it most emphatically. *Traube* and *Schoenlein* pursued a middle course. The latter looked upon fever as a benign reaction of the organism against inflammatory processes. Nature, he said, endeavored by the fever to master the causative factors of the inflammation. This favorable reaction, he declared, was easily disturbed by ill-considered venesection and other antiphlogistic applications. *Traube* arrived at the conclusion that fever and rise of temperature could only temporarily be moderated by bloodletting. The same results could just as well be obtained with quinine and cold applications. Weakening venesection should be replaced by a roborant therapy. The preservation of the bodily strength was of smaller importance than the depression of "vitality," which was already over-stimulated by the inflammatory process. But neither *Traube* nor *Schoenlein* rejected phlebotomy altogether. They still employed it in the sixties of the last century in cases of pleuritis and pleuropneumonia.

The Vienna school under *Skoda*, *Dietl* and *Oppolzer* condemned artificial bloodletting in unequivocal terms. They believed in and taught expectant symptomatic treatment, and their motto was: "Avoid injury" (*nil nocere*). Nature alone heals, and the physician's duty is to refrain from bloodletting and every other active interference. *Dietl* maintained that pneumonia could in no wise be influenced by bloodletting, neither could the hepatization of the lungs be prevented by it. According to his statistics, the mortality among the pneumonia patients who were treated in the Vienna hospital by venesection was three times as high as of those who received expectant treatment only. In some cases *Dietl* found tartrated antimony more effective than venesection. In expectant treatment he observed that,

although the dyspnea reached a higher degree, recovery was more complete than when venesection was employed. While bloodletting relieves respiration by removing the pulmonary congestion, it, nevertheless, enfeebles the body, and this retards convalescence.

If *Oppolzer* in his earlier days looked rather favorably upon venesection, he certainly became in his later years its bitter and unyielding opponent. The method of expectancy and warding off untoward influences, inaugurated by *Skoda* and *Dietl*, had carried the day along the entire line.

Yet venesection still endured until bacteriology had made those giant strides which finally brought light into the nature of the process of inflammation. It was the bacteriological discoveries which, for the present, gave the finishing touches to artificial bloodletting, at least as far as its most important indication, the antiphlogistic application, was concerned. The era of antiseptis and asepsis swept away the old theories of inflammation and began to work with new therapeutic and prophylactic factors. Venesection had entirely disappeared for some time from the armamentarium of the physician, when in 1886 *Krüger* could close his dissertation with the words: "There is no effect produced by venesection that cannot also be obtained by other means." This seemed to have given venesection the *coup de grâce*. *Junod's* boot was claimed to render the same service as venesection without entailing the latter's weakening effects.

It was but a year later that a small brochure appeared, entitled "Chlorosis and the So-called Anemia; Their Origin, Nature and Radical Cure," by Dr. *August Dyes*, Surgeon Major at Hanover. It was an attempt to resurrect the quondam popular remedy. *Dyes* had always been a strong believer in venesection, and

one day when he was called to the bedside of a hopeless case of chlorosis the thought came to him that by bloodletting he might shorten the death agony of the patient, a woman, twenty-four years of age, living not far from Bremen. Finding a much increased cardiac activity, he withdrew 100 grams of blood. Next day, instead of a corpse, he found the patient in a state of hopeful convalescence. She made a complete recovery within six weeks, and later on became the mother of healthy children. Instead of being haled into court, as a medical authority that was consulted had anticipated, Dyes became the recognized pioneer in the modern era of bloodletting.

*Dyes'* discovery was for a long time ignored by the profession, chiefly because he advanced many peculiar ideas, which did not always meet with general approval. For instance, he did not differentiate between chlorosis and anemia, nor between leucemia and leukocytosis. Only after he had succeeded in restoring the health of a young lady in Wiesbaden, who had been given up by the leading authorities, and when the daily papers were filled with encomiums anent this fact, did the medical world begin to take notice of the contemporaneous champion of the ancient remedy. At once *Wilhelmi* in Güstrow, *Scholz* in Bremen and *Schubert* in Wiesbaden came forward in his support. At first they met with strong opposition, for the medical men in general were still of the opinion that with the blood the strength and power of resistance were also withdrawn from the body. Gradually, however, artificial bloodletting regained some of the long-lost ground. But it was not until his hair had turned gray with age that Dyes was able to inspire a few patients with sufficient confidence to allow him to employ venesection or to set some leeches. This reluctance and scepticism

must be, in part at least, attributed to the fact that Dyes and his few followers were confronted by a closed phalanx of well-nigh all the medical authorities of the time, to whom some of the contentions and methods of the foremost advocates of the rejuvenated ancient practice must have appeared rather unscientific, crude and absurd.

*Dyes*, however, deserves the merit not only of having found a new indication for bloodletting, but also to have given its practice a new life. Fortunately the vampirism of the olden times, once for all, was dead. A critical study, however, of the indications recognized in the palmy days of bloodletting began, and guided by modern physiological, pathological and therapeutical investigations, many of them were weeded out, while others were added, among them chlorosis, anemia, uremia, eclampsia, intoxications, etc. *Von Noorden* confirmed the successes obtained by Dyes and his followers in chlorosis, with the modification, however, that bloodletting was withal a remedy fraught with some danger. *Eversbusch* obtained good results in changes of the visual organs following kidney disease. *Leube* recommended venesection in uremia. *Von Jaksch*, at first a strong opponent, became a fervent advocate of bloodletting. He employed it not only in pernicious anemia, but also in quite a variety of toxicoses. But now only small quantities of blood were withdrawn, for clinical observations and experiments had clearly defined the indications and contraindications of bloodletting, and had taught the necessity of saving the blood with the utmost care. This same view has remained the guiding principle ever since.

Germany's conduct in regard to the question of bloodletting influenced the other countries. *Macdougall* in America maintained that the immediate ef-



fect of bloodletting cannot be obtained by any other remedy in all cases where a disproportion between the tension and the motor power of the heart exists. Professor *Sacharjin* of Moscow, Russia, who had always been a strong believer in the efficacy of bloodletting, adapted it to the needs of modern science. *Fenwick* in England, *Hayem* in France, *Crocq* in Belgium strongly advocated venesection in accordance with the modernized principles.

In conclusion of this historical sketch it remains only to be said that no other remedy ever underwent so many vicissitudes. Now praised beyond merit, then unjustly condemned, venesection has retained its virility from the most ancient times to the present day. Like a phenix, the fabulous bird, it has outlasted the centuries and has risen, rejuvenated and with new vigor, from the ashes of the fire which threatened its destruction more than once. The people at large, undisturbed by academic strifes, have always been true to it. The physicians have extolled it to the skies or condemned it in the bitterest fashion in accordance with the prevailing status of scientific knowledge.

Although we again resort to this remedy of our ancestors when occasion arises, we practice it with a clear and accurate understanding of its physiological, pathological and therapeutical rationale, while they made rather intuitive use of it, employing it in accordance with custom, without discrimination, and on fanciful and fallacious suppositions.

## II. FUNCTIONAL CHANGES FOLLOWING BLOODLETTING

### A. Changes in the Amount and Distribution of the Blood

The object of bloodletting is to bring about a change in the quantity of the blood and its distribution, and favorably to influence its quality. In order to be enabled to aspire to these therapeutic aims in a systematic manner, it is essential, first of all, to have a clear idea of the physiological action of phlebotomy. The direct primary result of artificial bleeding is the reduction of the amount of blood, with which there will concur a diminution of the tension in the venous system until the original blood quantity has become re-established. In consequence of this, the flow of blood from the arteries into the veins is accelerated. In this way, the tension in the arterial vessels becomes also lowered and the heart's action relieved.

The reduction of blood pressure is in proportion to the loss of blood. The lowered blood pressure, however, usually disappears quickly, for which there are two reasons: First, the blood withdrawn is promptly replaced by an influx of lymph from the tissues; and, secondly, the vasomotor nerves immediately cause a constriction of the blood vessels to conform to the diminished amount of blood. A more prolonged lowering of the blood pressure after bloodletting is only observed when the diffusion of tissue lymph, that is, blood restitution, is retarded, or when the elasticity of the blood vessels is materially impaired by arteriosclerosis.

The decrease of tension in the venous system forms the physiological basis of the application of bloodletting for the relief of passive congestion in the lungs.

The immediate effect of venesection in pneumonia is not to alleviate or shorten the inflammatory process, but to avert imminent cardiac paralysis due to pulmonary blood stasis, and thus the organism is enabled to cope with the disease process itself. On the other hand, the therapeutic endeavors to improve the condition of the blood in anemia, chlorosis, etc., are based on the physiological fact that through phlebotomy the spleen and the bone marrow are stimulated to regenerate new blood.

Every loss of blood is followed by a certain degree of hydremia, owing to the inflow of tissue fluid into the blood vessels. This hydremia disappears as soon as the blood has been completely regenerated. The current of lymph increases markedly after venesection; however, the albumin content of the blood becomes diminished, the number of red in proportion to the white corpuscles become smaller, and the hemoglobin degree is lowered. The blood sugar is increased. The urine also becomes augmented. The body temperature declines. An agreeable languidness, followed by perspiration and drowsiness, makes its appearance. All these manifestations are, however, of a transient nature.

The total amount of blood in man equals about eight per cent. of the weight of the body. One-fourth of this may be withdrawn without material injury, as it is regenerated within a few hours. It is proved, however, that in this renovation of the blood the leukocytes flowing in with the tissue lymph are not changed into erythrocytes. If artificial bloodletting or a hemorrhage is not arrested after a certain amount of blood has escaped, the individual will become depleted, and succumb. This event, however, will not ensue unless about half of the amount of a person's blood has left

the body. After all, the entire amount of blood cannot run from the wound, as cardiac action already ceases when a certain amount has been discharged, or as coagulation ensues in consequence of the lowered pressure and the slower flow of the blood. Moreover, coagulation will be accelerated by the blood vessels contracting more and more as the amount of blood is declining. Convulsions always precede death from depletion.

The cause of death by depletion is cerebral anemia. In this two circumstances exert cooperative influence. Owing to the loss of blood, and especially of a large number of erythrocytes, the elimination of carbonic acid is decreased. It may, therefore, be assumed that the surcharge of the blood with  $\text{CO}_2$  impairs the action of the heart from the vagus center. With the growing embarrassment of the heart the remaining blood, by its own weight, accumulates, especially in the abdominal cavity. If half the amount of the blood still remaining in the body at the time of death by depletion were evenly distributed throughout the entire circulatory system, it might possibly suffice to prolong life for some time. *Strubell* opines that this unequal distribution is possibly due to the varying contractility of the blood vessels. Whether the progressive anemia of the brain and the embarrassment and failure of the heart may be retarded or averted altogether when the individual is in a dorsal position, with body elevated (high pelvic posture), whether, in other words, it is possible to direct the flow of blood toward the brain and thus to enable the organism to endure a loss of blood larger than one-half its total quantity, I have not been able to ascertain either through personal observation or from the literature at my command.

Death from bleeding may be averted by the infusion

of a normal salt solution (6 grams NaCl to 1 liter of distilled water). The main object is to restore the blood pressure and to maintain the action of the heart until the organism has found sufficient time for regenerating the blood. Instead of the saline solution, a transfusion of homogeneous blood may be made if a supply can be obtained. Heterogeneous blood is not tolerated by man, nor by any species of vertebrate animals.

In the male the quantity of blood is comparatively somewhat greater than in the female individual. In adults it is likewise comparatively larger than in children. In the newborn it amounts to only about one-fourteenth of the body weight (7 per cent.). Since a leech draws off an average of about 15 grams, and children having a comparatively smaller amount of blood are more affected by its loss, the old rule that the number of leeches to be used should never exceed the number of years of the patient's age has certainly some merits. Old people, fat persons and those suffering from marasmus have a more or less diminished amount of blood, and on that account are bad subjects for venesection. During pregnancy the quantity of blood is somewhat increased. Very stout individuals possess relatively the smallest amount of blood. Immediately after a heavy meal there is a temporary increase in the quantity of the blood, owing to the copious formation of chyle.

The most important physiological fact, so far as bloodletting is concerned, is the auto-regulating forces of the organism. Excess and lack of blood, loss and compensation quickly establish the normal condition. This is occasioned by the fact that the vascular structures, even when intact, are permeable, permitting an uninterrupted interchange between the



blood and the tissue fluids. It is this permeability, together with the influence of the blood pressure and the stimulation due to the vasomotor nerves, which admits of the incessant egress and ingress of diffusible material through the vessel walls of the closed tubular system, the vascular apparatus.

As has already been stated, the elasticity of the blood vessels plays an important rôle in this auto-regulation of the organism. Without this elasticity it would be impossible so to regulate the osmotic conditions of the blood that its quantity and composition remain approximately constant. Normally the blood vessels are only partly filled; the vascular walls being elastic and expansible, they could easily accommodate a much larger amount of blood than is generally contained within them. On the other hand, the blood vessels by reason of their contractibility can adapt themselves to a volume of blood that is much smaller than the normal amount. Any excess of water soon leaves the blood by way of the kidneys. Deficiency of water is promptly compensated for by the absorption of water from the tissues. This adjustment takes place with such rapidity that even a large inflow of fluid (as by copious drinking) or an appreciable loss of fluid (as excessive perspiration) is scarcely noticeable in the water-content of the blood.

We must also consider the vast differences in the mode of living of individuals, of nations and races, in various latitudes, in the torrid, the temperate and frigid zones, and that, nevertheless, the blood is almost universally constant in quality and quantity as well. The influence of self-adjustment is here very pronounced. In nearly every part of the globe the blood of the human race exhibits the self-same proportions of albuminates, carbohydrates and salts. Even in the

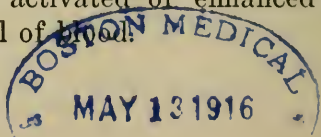
absence of certain foodstuffs, or in inanition, the blood composition remains unaltered for a long time. Increased ingestion of albumin is followed by increased elimination of its decomposition products; deficient introduction of salts results in the retention of the salt components in the blood. Superfluous blood corpuscles disintegrate; if there exists a deficiency of corpuscles, additional ones are formed—always at the rate they are needed by the organism. It may rightly be said that with almost every change of food another chyle and another blood is produced, but that the latter does not show any noticeable alteration in amount as well as in composition.

### B. Changes in the Composition of the Blood

In high altitudes, owing to the rarefaction of the air, an apparent increase of the erythrocytes and also a stronger concentration of the blood takes place. Upon returning to a lower level these manifestations disappear again. The hemoglobin content of the blood is somewhat higher when a person is on highly nitrogenous than on nitrogen-free food; and again it is higher when a meat diet than when a vegetarian regimen is being pursued. Together with the hemoglobin content of the erythrocytes, the specific gravity of the blood rises and falls.

If it is the blood that maintains the intercourse of the organism with the outer world, conveys the intrasystemically produced carbonic acid gas to, and the inspired oxygen from, the lungs, takes up the elaborated nutritive elements from the digestive tract and the lymph through the thoracic duct, then it must also, according to the same physiological laws, absorb abnormal substances in solution or in the form of gas. Life would be forever endangered by the metabolic prod-

ucts which are formed incessantly in the body if the power of self-regulation did not, to a certain extent, cause a continuous elimination of toxic substances from and through the blood. In addition to abnormal or excessive amounts of normal products of retrograde tissue metamorphosis, there may occur in the blood abnormal admixtures of ectogenous origin, such as bacteria and their products, medicinal and food poisons, noxious gases, etc. All these toxic substances reach the blood and are often carried by the circulation into far removed parts of the body. Under these circumstances it is entirely due to the self-regulatory forces of the normal organism if this toxic material is generally eliminated from and by the blood within a comparatively brief period. Numerous foreign chemical substances travel with marked promptness from the blood into the organs of elimination (lungs, intestines, kidneys, and skin), and leave the body together with the physiological excretions. Various clinical observations and experimental investigations, made for the purpose of solving the problem of infection and immunity, have demonstrated that pathogenic microorganisms circulating in the blood are quickly absorbed and destroyed by the cells, and that the cells by producing and supplying the blood and the tissue fluids with antibodies can render bacteria and their toxins harmless. I cannot enter into details here, for this chapter deals solely with the physiology of bloodletting. Suffice it to say that the property of self-adjustment and the tendency of eliminating abnormal blood components are not in any way impaired by bloodletting, as some of its adversaries maintain, but that, on the contrary, the regulatory and protecting forces of the organism become activated or enhanced by the therapeutic withdrawal of blood.



It was left to modern science to place the physiology of the blood and with it that of bloodletting on a definite basis. Nevertheless, the modus of auto-regulation and blood renovation has not yet been investigated in all its details. However, these points we know with certainty, namely, that it is not merely a question of physico-chemical processes and that the blood is more than an aqueous solution of albuminates and salts of definite concentration. "Blood is more than a fluid," says *Köppe*, "in which blood corpuscles float about." The fact that the entire water intake and outflow in the organism is under normal conditions accomplished without influencing, even if but transiently, the water content of the blood, permits of the conclusion that when there ensues fluctuation in the water content of the blood this is not merely the result of filtration and blood pressure, but the outcome of certain disturbances in cellular activity. There are a number of physiological processes which, by proper cooperation, maintain constancy in the quantity and composition of the blood. Blood corpuscles and blood plasma, the entire vascular contents and the vascular walls, the latter's elasticity, contractility and permeability—all these factors are interdependent and must work together like a unit in order to fulfill the physiological task of the blood. All metabolic processes of the tissues and organs of the body are carried on through the medium of the blood. From the blood the bodily structures draw their entire nutritive material, into the blood they return any possible surplus and all the products of their metabolic and catabolic activities. Many of the latter, having found their way back into the blood in one location, become part and parcel of the tissue fluid elsewhere in the organism. In this manner the same molecules in different combinations

may repeatedly become constituents of the blood until, finally, they will be eliminated by the various excretory organs as effete substances, being no longer of any value to the animal economy.

It is self-evident that with this intimate interchange every anomaly of tissue metabolism must be reflected in some degree in the composition of the blood. And, vice versa, blood anomalies which are not compensated for by the regulatory forces must necessarily implicate the tissue metabolism. It is, therefore, a matter of great frequency to find in the blood in certain pathological states large amounts of such metabolic and catabolic substances, which, under normal circumstances, can either not at all be demonstrated therein, or will be components of the blood—in tangible amounts—for brief periods only. All these facts are, as will soon be shown, of great import in the theory of bloodletting.

It has already been stated that the self-regulatory forces of the blood are not unlimited. The regulatory properties of the organism need time for developing proper activity and can only accomplish a given task in a given time. If, during this given time, new untoward factors arise, or in case the untoward factors are of such a nature that the regulatory mechanism avails little or nothing, they must by necessity remain uncompensated. Taking for granted the integrity of the spleen, of the red bone marrow, the blood vessels and the vasomotor nerves, self-regulation must yet prove a failure, when the bleeding is so rapid and copious that the newly formed blood is also carried away before the organism has had time to compensate the loss. Under such circumstances it would be of little or no avail if toxic and other abnormal substances contained in the blood were removed from the



body by venesection. The forces of self-regulation must prove still more inadequate when the organs of blood production and of blood circulation are themselves already in such an impaired or crippled condition that they cannot even respond to lesser demands. When one realizes the preeminent importance of the blood in the body economy, one will be able to appreciate the grave consequences that needs must follow a permanent disturbance of the self-regulatory forces even in the absence of further complications. This, also, is self-evident, that the question of indications and contraindications of bloodletting is in the last instance determined by the efficiency or inefficiency of the self-regulatory forces and the integrity or functional deficiency of the organs of circulation and hemato-poiesis.

The investigations of *Köppe* and of *Hamburger* have thrown much light upon the subject of osmotic tension. *Hamburger* determined the osmotic tension in rabbits in every phase of slow and gradual depletion. By the freezing point determination he was enabled to show that osmotic tension remains tolerably constant under physiological conditions.

*Köppe* also demonstrated in rabbits the osmotic tension of the plasma before and after bloodletting. Three experiments gave the following results:

	1	2	3
Before bloodletting.....	0,2425	0,255	0,2525
After bloodletting.....	0,2525	0,2625	0,2525

In one case, then, the osmotic pressure remained unchanged after bloodletting; in the two others there occurred an unimportant rise after the procedure. The red corpuscles had largely decreased in number.

*Köppe* ascribes this to the circumstance that they possess a lesser viscosity than the leukocytes, and are thus more readily carried along by the escaping blood. A pronounced dilution of the blood plasma by tissue lymph corresponded to the diminution of the red blood cells. However, since the osmotic tension had hardly changed, it is evident that the osmotic conditions that prevailed in the plasma and the tissue lymph must have been identical. *Köppe* ascribes the slight rise following bloodletting in the two cases just mentioned to the diminished elimination of carbonic acid gas after the loss of a considerable number of erythrocytes. These results are, of course, not absolutely applicable to the human organism, since experimental bloodletting, continued until complete depletion has been attained, can, naturally, be undertaken with animals only.

*Magnus* found a slight freezing point depression after venesection. Other authors contend that the freezing point is depressed only in cases in which a few venesections had been performed in quick succession. Together with the freezing point, the albumin content of the blood is also lowered. In hyperemia the specific gravity of the blood is diminished; when the blood is inspissated, its specific gravity rises, owing to the great loss of its watery menstruum.

According to *Strubell*, bloodlettings of from 180 to 500 grams relieve the heart's burden, promote the secretion of the urine, eliminate abnormal substances contained in the blood, and vigorously stimulate the hematopoietic organs. It may appear paradoxical that blood should be withdrawn in order to procure new blood for the body. But he who understands the physiology of bloodletting will not consider this a contradiction. Repeated abstractions of small amounts of

blood promote, according to *Strubell*, the formation of adipose tissue.

The health of an organism depends on the existence and maintenance of its osmotic equilibrium. By osmotic equilibrium I understand that inter-relation of the physical conditions of the various body fluids—molecular concentration, osmotic concentration,\* tension and dissociation—which is essential for the normal performance of the vital processes. This inter-relation does not consist in the equality, but in the physiologic dissimilarity of the osmotic conditions in the different fluids. In certain pathologic states, the fluids in the organism tend to equimolecular or equiosmotic concentration; the normal processes of life, however, are possible only so long as this uniformity is not established.†

It is the special office of the organs of secretion and excretion to maintain the osmotic equilibrium. A structural alteration of one or more of these organs, causing functional impairment, is liable to result in serious disturbance of the osmotic equilibrium. The functional impairment of such an organ is demonstrable by the altered osmotic tension of its secretion or excretion, which again may be an indication of the modified osmotic conditions in the blood. Normally, the secreting organs withdraw from the blood a certain amount of water, in which are dissolved specifi-

\*While "molecular concentration" indicates the number of moles (gram-molecules) contained in a liter of fluid irrespective of an eventual dissociation, "osmotic concentration" as suggested by Hamburger (*Osmotischer Druck und Ionenlehre*, 1902) is the expression of that concentration indicating the total amount of molecules + ions contained in a liter of the physiologic or pathologic fluid.

†Complete uniformity of all partial osmotic tensions supervenes at no time and nowhere in the organism. Such uniformity would result in the cessation of the tissue currents, but there is absolute proof that such cessation can never occur; in the dead human organism even these constant currents may be yet demonstrated.

cally proportionate quantities of inorganic and organic salts. The diseased emunctory is unable to cope with the secretion work, the absolute amount of water and salts withdrawn by it from the blood and tissues falls short of that which it eliminates when functioning properly. Furthermore, the amount of water and solids secreted or excreted by a diseased organ may be in disproportion, that is, while the absolute amounts of both are diminished, the relative water or salt output may be still further reduced. The disturbance of the osmotic equilibrium between the body fluids and between the blood and the secretion or excretion progresses or regresses, as a rule, at the same rate as the structural changes in the parenchymatous tissues increase or subside.\*

While the intrasystemic osmotic disturbances may be but rarely determinable by our present clinical means, the disturbed osmotic equilibrium between blood and secretion is soon demonstrated by simple physical methods. The degree of osmotic disequilibrium between blood and secretion is both an indicator of the intensity and the course of the pathologic process in the parenchymatous structures as well as of the influence of the therapeutic measure exerted on it. If there be a tendency to restoration of the osmotic balance, that is, if the insufficiency of the organ is gradually giving way to physiologic activity, the plan of treatment should be further pursued. If, on the other hand, improvement does not ensue after a protracted period, or if equilibration becomes still more

\*In certain phases of degenerative processes the insufficiency of an organ may yet for some time be averted by its unaffected cells; in case even that an organ has entirely ceased to functionate, another organ or set of organs may display vicarious activity, so that for the time being osmotic disturbances either do not ensue at all or are kept at a minimum.

distant, the therapeutic measures should be at once replaced by more rational ones.

Pharmacologic action is not of an exclusive chemical nature. This fact, although not pronounced in so many words, was already recognized by *Schmiedeberg* when he says that the molecular processes, as distinguished from those occurring between the atoms, should be taken into consideration when defining "chemical action." Further proof of his conception of "physical action" is furnished by his explanation of the non-toxic action of distilled water after its ingestion.

It is not often possible to distinguish between chemical and physical action; where the one ceases and the other begins is indistinguishable in almost every instance. We may assume even that the action of a great number of substances on the living cells is both of a chemical and physical nature. Purely chemical or purely physical action is exhibited by comparatively few remedial agents. In so far, however, as one or the other mode of action predominates, we may differentiate between substances acting chemically and such that will display physical activity.

Again, pharmacologic action is determined by the constitution of the cells or cell-complex reacted on. Thus, a substance or a remedial procedure may not cause any reaction in the protoplasmic molecule—it may neither stimulate nor depress; or it may influence cellular function by calling forth chemical alterations of the cellular material, the specific composition of which invited chemical reaction; or it may modify tissue function by changing the molecular constitution of the intracellular or extracellular fluids. Whatever the mode of the action of a substance or a remedial procedure on living protoplasm may be its influence is one of a modifier only, that is, it may excite and



increase or reduce and suppress functional activity, but it does not occasion any new function.

Ever since the advent of solidar pathology and the doctrines originating therefrom, the chemical nature of pharmacologic action was the one principally studied. Although the laws of endosmosis and exosmosis were known then, but few pharmacologists devoted sufficient attention to the physical side of pharmacologic action. And yet, the physical action of drugs or of a procedure like bloodletting is so much simpler, is so much easier of comprehension than the complicated, only to the most rudimentary degree understood chemical drug action. I cannot offer an explanation for this historical phenomenon, but it occurs to me that much could have been accomplished in the physical domain of pharmacology even before the rise of Van't Hoff, Arrhenius and Korányi.

By physico-pharmacologic action I understand that influence which is exerted on the living cell by directly modifying the molecular constitution of the intracellular or extracellular fluids without synchronous alteration of the chemical structure of the protoplasm.

It is by such physico-pharmacologic action that I explain the beneficial influence of general bloodletting upon the diseased organism. As a matter of fact, we possess no more certain or more powerful physical remedy than bloodletting. When the indications for its employment are definite, this agent cannot fail, provided the amount of blood withdrawn is the proper one. This statement does not pertain to an eventual coarsely mechanical relief that may be afforded by the abstraction of blood, as may be the case, for instance, when the right heart is embarrassed in pneumonia. Such coarsely-mechanical effect can never be counted upon with absolute certainty. However, when it is a

question of a disturbed osmotic equilibrium, suspended transudation of blood plasma through the vessel walls, capillary sluggishness or arrested movement of the lymph from the tissues to the veins, then bloodletting is at once the most direct and rational remedial agent. And again, if this procedure be combined with an intravenous infusion of an isotonic or rather a somewhat hypotonic sodium chlorid solution, the osmotherapeutic value of bloodletting is still more enhanced.

In the same sense in which osmology is the science treating of the physical conditions of and in the body fluids, osmotherapy is that mode of treatment, the ultimate aim of which is reestablishment of the normal physical conditions, the osmotic equilibrium. In its last instance, osmotherapy regulates the electrical conditions in the body fluids. Osmotherapy produces physical stimulation or depression by withdrawing, supplying or dissociating molecules; physical stimulation, again, is a mediate result of increased physical depression, that of diminished electrical conductivity of the intercellular or intracellular fluids.\*

The remedial agents whose foremost action is the physical one, I have designated as "equilibrants." They may be divided into four great classes:

1. Agents exerting specific localized activity; agents influencing the secretory and excretory functions of the diseased organ by transitory or permanent restoration of normal semi-permeability.

2. Agents regulating the perverted osmotic conditions of a certain body fluid, or maintaining a general osmotic equilibrium for the time being.

3. Agents whose principal action depends on their

\*I do not consider the non-dissociated molecules of the same importance as the ions, between which the reactions occur with greater ease and rapidity than between the former. The majority of the physical pharmacologic reactions very likely occur between the ions.

ions; agents which influence the electrical conditions in the system.

4. Agents with combined action; agents exhibiting two or all three actions enumerated.

It is in my opinion the osmotherapeutic properties of bloodletting, heretofore unrecognized as such, that render it of such great value in quasimoribund cases. And it is primarily on account of these osmotherapeutic properties that it has outlived all other therapeutic agents, except the application of heat or cold, and that it has endured for the long chain of centuries in spite of all the hocus-pocus that was connected with its application. It is the foremost of all equilibrants, and, combined with an intravenous infusion of a slightly hypotonic sodium chlorid solution, it may exhibit all the actions of above enumerated three categories of equilibrants.

As far as the loss of erythrocytes is concerned, it is a fact, according to *Snapper's* observations, that the red cells generated after bloodletting possess greater power of resistance than the red blood corpuscles removed by venesection, and that this resistance waxes even stronger with every subsequent venesection. Besides, more blood cells are formed after the withdrawal of blood than the organism has lost by the phlebotomy. *Weigert's* law is applicable right here. It declares namely that whenever there ensues functional decline or deficiency of body cells, it is followed by so extensive a proliferation of the neighboring cells that over-regeneration takes place. *Jürgensen's* objection to venesection, based chiefly upon the presumed loss of erythrocytes, is met, therefore, by the overproduction of the red blood corpuscles and their increased power of resistance. *Snapper* arrived at the following conclusions:

1. Regeneration due to loss of blood is best studied by the calorimetric determination of hemolysis produced by hypotonic salt solutions.

2. Young erythrocytes are much more resistant to hypotonic salt solutions than older erythrocytes.

3. We are compelled to assume that young red blood corpuscles originate from the old ones.

However, it is not likely that the blood cells which still remain in the body suffice to cover the entire loss. For this reason, entirely new formation of corpuscles must take place. This reproduction usually occurs with considerable rapidity. According to *Grawitz*, the hematopoietic organs are the only factors in this manufacturing process. Iron is not a specific in the treatment of chlorosis, but its action is chiefly that of a stimulant of the hematopoietic organs. *Grawitz* claims that the regeneration of blood cells is retarded by tuberculosis and the systemic affections in general. Repeated venesection and other casual losses of blood effect not only an increase in the resisting power of the erythrocytes, but also augment the coagulability of the blood. The ensuing perspiration, characteristic after bloodletting, is undoubtedly a very favorable manifestation; occasionally, however, it is possible that hot baths may produce a similar result. But the mediate and immediate effect of bloodletting is so potent that other diaphoretic agents can hardly be compared with it.

*Van der Velden's* experiments have also demonstrated increased coagulating properties of the blood after venesection. While the blood is being withdrawn, inspissation followed by dilution supervenes; this, at any rate, is the case in the vascular area directly affected by the loss of blood. The blood dilution is due to the absorption of tissue lymph, by which also

the substance causing clotting (thrombokinase) is transmitted to the blood stream.

Again, it is rather strange that the influence of blood-letting on the lymph movement has not as yet been made the subject of more exhaustive study. Unfortunately, it is true that our knowledge of the pathology of the lymph is only patchwork, and our conception of lymph stasis in its clinical aspects is extremely vague. From what has been said, however, it is evident that venesection seems to exert the same potent influences on the lymphatic as on the hematopoietic and circulatory systems.

*Lawrence* used nitrites, hot air baths, high frequency currents and electric light baths in order to ascertain whether the tension in the venous system and the blood pressure could be lowered as efficiently by means of medicaments and physical therapeutics as by bloodletting. His experiments gave the following results:

1. Nitrites, phlebotomy, electricity and hot air lower venous tension and reduce the action of the heart in such a manner that, as a rule, the diastolic pressure equals only one-half of the systolic pressure.

2. This pressure-coefficient approaches the normal in a greater degree than does the pressure-coefficient in the state of hypertension.

3. Sodium nitrite causes a more rapid decline in the diastolic pressure than the complex combinations mannitol and erythrol.

4. No drug of this group is able to lower the pressure for any length of time, as intolerance soon sets in, and larger doses may leave unpleasant symptoms in their wake.

5. Phlebotomy produces a more lasting reduction of pressure than do the nitrites, electricity or hot air. The decrease in diastolic pressure is more prolonged



than that of the systolic pressure, and in consequence the pulse pressure is increased.

6. The effects of hot air baths, electric light baths and high frequency currents are uncertain, as these procedures, at best, produce but a transient lowering of the pressure.

7. Vasotonin cannot be recommended. Its action is uncertain, and an increase of the dosage is fraught with danger.

8. In cases of persistent hypertension the effect of the general decrease of pressure on the renal functions is well marked.

*Oliva* attempted to determine by experiment the exact nature of the physico-chemical changes taking place in the blood after bloodletting, after subcutaneous infusion, and after bloodletting followed by infusion. After bloodletting the specific gravity of the blood is lowered, owing to the efflux of lymph and the consequent dilution of the blood plasma. For the same reason the viscosity of the blood cells is also lessened. The increased flow of lymph into the blood reduces the latter's relative amount of proteid substances, for the proportional amount of albumins is smaller in the lymph than in the blood. On the other hand, the electric resistance of the blood is increased after venesection. All these manifestations, however, are only of a transient nature; the normal condition being restored in not longer than about eight hours.

In venesection with subsequent infusion the specific gravity, the viscosity and the percentage of albumin in the blood are still further reduced. This is due to the combined action of the two remedies. However, the electrical resistance is diminished, owing to the action of the saline solution, which calls forth an increase in the electrolytes.

*Oliva* states expressly that toxic substances are removed from the blood by venesection, and that the elimination of noxious elements is facilitated by the infusion. The infusion, he maintains, does not only render excellent service in conditions characterized by water-deficiency in the structures and fluids of the body, but contributed also to the dilution, i.e., the detoxication of the poisonous substances that still remained in the organism. According to *Oliva*, therefore, the effect of venesection would by no means be confined to the elimination of toxic elements, but would amount, so to speak, to a direct and exceptional cleansing of the entire system.

I may here mention the interesting experiments of *Hess* and *Saxl*, by which they have demonstrated hemoglobin-destroying properties of the liver. By the exhibition of small doses of arsenic, pilocarpin, caffeine, opium, adrenalin or strophanthus, the hemoglobin-destroying function of the liver could not only be suspended, but also an increase in the erythrocytes could be obtained. If by the withdrawal of large amounts of blood the experiment animals were rendered anemic, blood regeneration was facilitated by bringing into the circulation dissolved hemoglobin, hemin or hematin by either subcutaneous, intravenous or intraperitoneal injection.

The artificially induced condition known as phlebostasis deserves mention in connection with the physiology of bloodletting. *Lilienstein* uses this term to signify the production of a venous stasis in the extremities by means of elastic cuffs, which, when inflated, sufficiently compress the segment of the limbs which they encircle. Phlebostasis is, so to speak, a bloodless withdrawal of blood in the sense that a certain amount of blood is for a time removed from the circulation with-

out incurring any actual loss of blood to the body. If the blood circulation is interrupted in the extremities by compression, the force proceeding from the heart—the systolic pressure as well as the diastolic aspiration—is concentrated in a smaller vascular area. In a given case, the force of the heart contractions can naturally produce better effects in this narrowed field, and the heart is enabled to rally during the time of the artificial venous stasis and the contractions following for a brief period thereafter.

The longer the phlebostasis is continued, that is, the longer the venous flow is arrested in the extremity encircled by the compressing elastic cuff, the more the interchange of gases between the retained blood and the tissues it drains, and also between the retained blood and the general circulation, is inhibited. When the venous stasis is relieved, i.e., when the retained blood is permitted to re-enter the general circulation, a smaller amount of the venous blood is carried to it than would have been the case if the superficial circulation in the extremity had continued right along. Thus, though slowly and in successive stages, a more perfect arterialization may be secured. In healthy persons *Lilienstein* has not been able to observe any marked reaction on the heart by artificial peripheral venous engorgement. On the other hand, in patients affected with disturbances of cardiac compensation, dyspnea and other symptoms of stasis in the lesser circulation disappear as soon as phlebostasis is produced. Moreover, there is no loss of erythrocytes when this “bloodless bloodletting” is resorted to.

It is soon three years that I have started to employ phlebostasis, and after having used it in upward of five hundred cases, I am able to fully endorse the findings of *Lilienstein*. This pertains as well to its

therapeutic as to its diagnostic value. A single application of the procedure will often relieve for days the most pronounced decompensation phenomena. Dyspnea is promptly relieved in every instance, the improvement lasting, as a rule, for from three to four hours. In diagnostic respects the method has also definite merit in so far as it permits to differentiate between compensatory disturbances and other affections of the heart, viz., when psychic influences may be excluded, the disappearance of dyspnea and its concomitant phenomena, when the patient is in phlebo-stasis, of necessity points to the presence of cardiac decompensation.

### III. PRESENT STATUS OF THE TECHNIC OF BLOODLETTING

#### A. Bloodless Methods

It sounds like a paradox when we speak of "bloodless" methods in bloodletting. The contradiction, however, is only an apparent one. It is not always necessary actually to withdraw blood and diminish its quantity in the body. At times it suffices to direct the blood from an inflamed part of the body or from an organ in such a manner that the total amount of blood remains intact, but that the congestion is relieved by diverting the blood accumulation. For this purpose dry cupping is generally resorted to, but phlebostasis may also yield satisfactory results. The cups may be of glass, rubber, or of a combination of the two. Those most commonly used are bell-shaped, with an opening somewhat narrower than their body. The edges of the glass are rounded off and are thicker than the rest of the cup; the diameter at the mouth is from 3 to 5 cm. In other styles of cups the diameter of the opening does not differ from that of the bell. Whiskey or wine glasses of about two ounces' capacity can be very well utilized in cases of emergency. The ordinary thick tumbler with smooth rim may also be employed, but its comparatively great weight—not less than six should be applied at the time—may preclude its use in many instances. Of the special cupping glasses, from six to twelve are necessary to produce the desired effect. There are also cupping glasses provided with stop-cocks, from which the air is removed by a suction pump.

Before the cups are applied it is essential that the



parts be entirely freed from hair by shaving, and that they be thoroughly cleaned with warm water. Care should be taken that the skin remains moist, as this will facilitate the adhering of the cups. If these are of the ordinary kind, the air within them must be rarefied by either holding them over a flame or by wiping some alcohol upon the internal surface of each cup, after which it is ignited. The latter process is by far the most effective. There must be no excess of alcohol, as but a small flame is needed to completely exhaust the air in the cup. The moment the alcohol begins to burn, the cup should be rapidly, firmly and evenly applied to the part. If the entire edge of the cup "sits" well upon the skin, so that no air can enter beneath it, the flame will be extinguished before the patient feels its heat. Of course, a certain amount of practice and dexterity is necessary, so that the patient is not injured by a cup that has been allowed to become overheated, and that the cup be quickly and properly applied. Cupping is only then a successful operation when the cups fit hermetically to the skin, so that no air can enter them. An effective vacuum, drawing up the textures beneath and causing congestion therein, is produced when the cupping is done correctly, i.e., the drawn up tissues become much reddened on account of the dilatation of the blood vessels and their greater fulness. After a few minutes, when sufficient congestion has been induced, the cup is removed by holding it and pressing down the skin on one side of the edge. As soon as the air enters, the cup drops off.

Of course, the congestion obtained in this manner, i.e., the deviation of the blood from the inflamed part of the body to the cupping region, is only of a transient nature. After the removal of the cup the local hypere-

mia produced in the cupping region gradually subsides, and the induced local anemia in the focus of inflammation is slowly replaced by the original congestive state. For this reason, the procedure must be repeated if necessary, but care should always be exercised that the cup is applied only on parts where the surface is large enough to accommodate the entire aperture of the cup.

It would be a mistake to apply cups directly over the inflamed region, for not only would the pain be increased, but the hyperemic process would become aggravated.



FIG. 5

A Cup Made of Rubber

Cups made entirely of rubber are readily applied by simple compression. When the air has thus been expelled, the cup is placed upon the skin and released. As the cup expands, it sucks the skin and underlying tissues up into the vacuum. Glass cups are, however, preferable, because they are transparent, are more durable and easier to clean. In cups made of glass and rubber the latter forms a bulb for exhausting the air. This arrangement dispenses with the heating and yet allows of observation of the cupping area through the glass bell.

For ambulatory cases the exhaustion of the cupping glasses is best procured by the electrical suction pump. The glass cups used with this apparatus do not diminish in diameter toward the thickened edge, are usually smaller than ordinary cups, and terminate on the top in a strong but short glass tube, which by

means of a rubber tube is brought into direct connection with the electrical suction apparatus. The glass bell is applied to the skin after the pump has been set in motion. It is possible to obtain much more lasting results by the aid of this appliance than can possibly be procured with the ordinary cupping glasses, because a much more intense hyperemia may be produced. The apparatus may be allowed to work for fifteen, thirty or more minutes, and thus the artificially induced local hyperemia may be prolonged at will. Naturally, the cup adheres to the skin only so long as the pump is in operation. I have employed this method for many years with satisfactory results. Wet cupping may also be performed with the same apparatus, i.e., the skin is scarified, the cups placed over the scarified area, and the electric pump by suction will draw the blood into the cups.

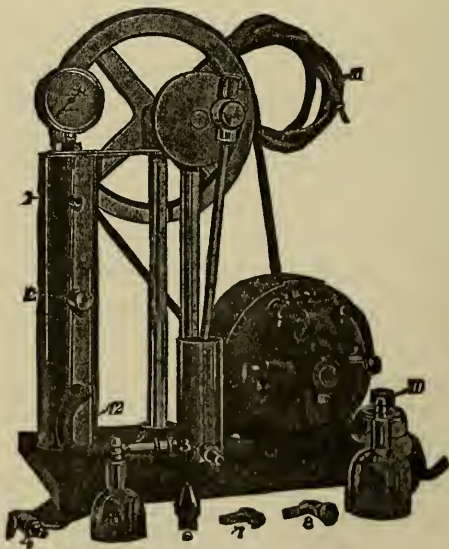


FIG. 6

Electric Air and Vacuum Pump, with Cups, etc.

Of course, the effect of cupping is always a more or less limited one, both as regards duration and the area influenced. In order to intensify the hyperemia and to extend it over entire parts of the body, *Junod* constructed large containers, which would accommodate an entire extremity. These containers, originally made of metal, but later of leather, are supplied with a wide

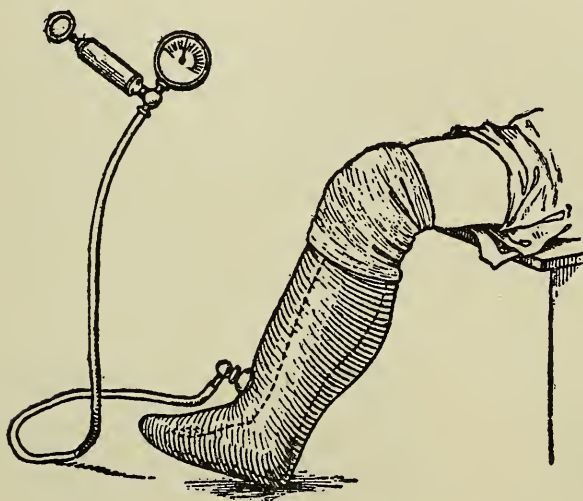


FIG. 7  
Junod's Boot

strip of rubber fabric around the top opening, through which the limb is inserted. This strip of rubber legging, which lies close to the skin, excludes all access of air. By means of an air pump attached to another opening, a vacuum is created in the boot-shaped case, and the blood is forced into the whole area held captive within it. The blood vessels and textures of the limb become dilated; the local hyperemia and the corresponding anemia of the rest of the body are sometimes so severe that vertigo and syncope may super-

vene. For this reason great caution is advised when Junod's boot is brought into requisition. It is also well to remember that its application is a very painful operation. There is, however, no doubt that it may relieve congestive states of the abdominal viscera.

Phlebostasis is another method by which the blood from the congested area may be deviated to distant points. The *modus operandi* of this procedure has already been described. *Lilienstein*, taking the blood pressure of a patient with congestive manifestations in the thorax, by means of an ordinary blood pressure apparatus and a von Recklinghausen cuff, noticed that these symptoms abated during the compression period and that the relief lasted for some time. He continued to make use of this compression method in suitable cases, and finally demonstrated its therapeutic value. The cuffs ordinarily employed in sphygmomanometry may be made use of. Two cuffs, one to be applied around each arm, suffice in the average case. At other times, three or four cuffs are necessary. These are to be applied around the upper segments of the thighs. The cuffs are connected with (1) a manometer, (2) an inflating apparatus, and (3) a valve for the escape of air. Compression of the cuffs should be just sufficient to suppress the wrist-pulse. This should be felt during the entire procedure and the pressure ascertained with the aid of the manometer. Inflation may be done by the ordinary rubber bulb and balloon. Should there be a compression greater than necessary to suppress the wrist-pulse, air should be allowed to escape through the valve, which is worked by hand, until the pulse is felt again. *Lilienstein* continues the compression for from two to three minutes, but repeats the procedure four or five times.

In ambulatory treatment I have long ago substituted



the electrical force pump for the bulbous inflating appliance. Not only that one hand of the operator is released thereby, but he can devote his entire attention to the manometer, the wrist-pulse and to his patient in general. Moreover, a continuous compression of uniform degree can readily be kept up by the electrical force pump for any length of time. By

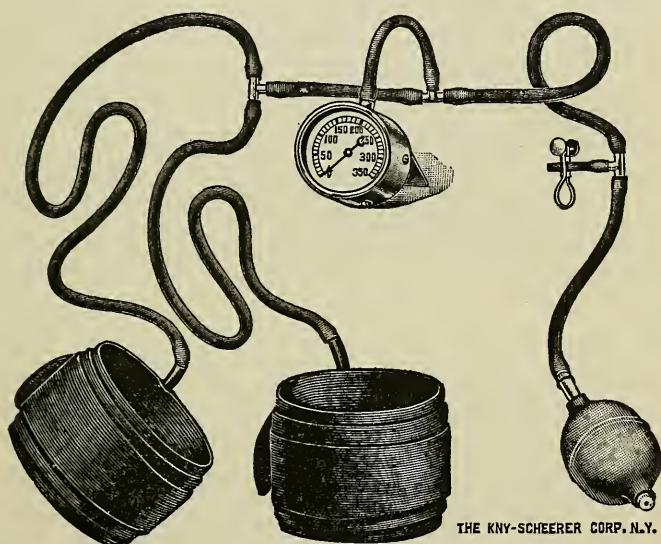


FIG. 8

The Phlebostate

means of the hand-valve the pressure may be kept at a desired degree, and the arm-cuffs be emptied or allowed to become more densely inflated. In new cases I employ phlebostasis in a tentative way, that is, I use but moderate compression—about 5 to 10 mm. Hg. less than is necessary to suppress the wrist-pulse—and discontinue after a minute or two. In cases where I am absolutely certain of my ground, where there is no tendency to thrombosis, and no varicosis or edema of

the extremities that are to be compressed, I always continue the phlebostasis for from ten to fifteen minutes. In cases that are more stubborn, as, for instance, headaches of a migrainous character, it may be applied up to twenty-five or thirty, or more, minutes.

Compression of the upper segment of both arms withholds from the active circulation in the neighborhood of 300 c.c. blood. Compression of the upper segment of both thighs retains therein from 450 to 600 c.c. blood. By the compression of all the four extremities not less than from 750 to 900 c.c. blood are, therefore, prevented from circulating for the time being. In other words, blood equivalent to that withdrawn by a profuse bloodletting may be kept from the blood current by this procedure. In this manner marked relief of the right heart and of the pulmonary circulation may be afforded.

In order to facilitate the application of the phlebotatic method, I have devised an apparatus in the form of a chair. This chair is an ideal means for the employment of phlebostasis in the office, hospital or the home.\* The four cuffs, two for the upper and two for the lower extremities, are always ready for use and are attached to cutoffs, so that any or all, or any combination of them, may be inflated. Inflation is accomplished by a small electrical force pump. The manometer is mounted on the chair in such a way that the dial is readily visible by the operator. The apparatus may, of course, be utilized for purposes of blood pressure determination. A hand-valve to regulate the compression and to let out the air is part and parcel of the outfit. A self-acting valve, permitting the escape of air forced into the tubes and arm-cuffs when

\*The phlebostasis chair is being manufactured by the Kny-Scheerer Company, New York.

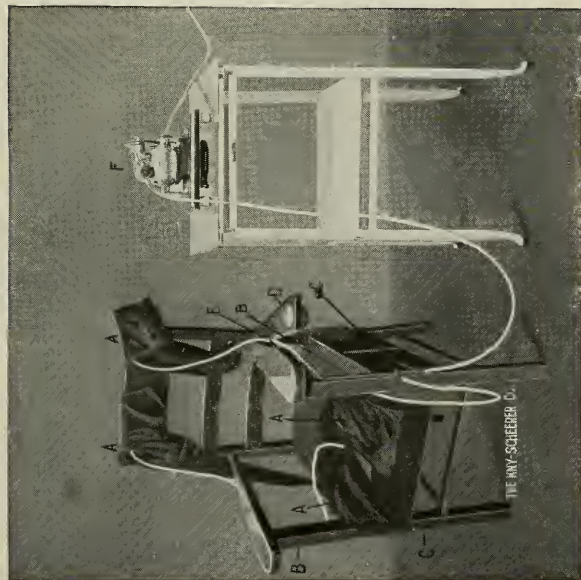


FIG. 9

EXPLANATION OF PARTS.—A A, Inflation cuffs for arms and legs. B B, Cutoffs for arms. C C, Cutoffs for legs. D, Manometer. E, Valve. F, Electrical force pump.

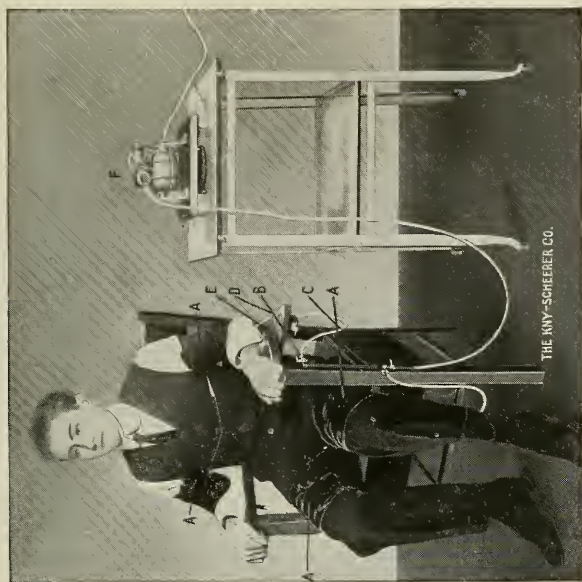


FIG. 10

### Phlebostasis Chair



it exceeds the degree of pressure to which it has been adjusted by the operator, may be supplied with the apparatus.

When using the phlebostatic chair, the operator holds the hand-valve in one hand while with the other he is able to shift the stethoscope from place to place in case he wishes to examine the patient while he is under the influence of phlebostasis. However, the patient himself may frequently be entrusted with the working of the hand-valve. In this way the operator has his two hands released, and he can even percuss during the compression period. When the chair is supplied with an automatic valve, both hands of the operator are released, as a matter of course.

Cases illustrating the clinical value of phlebostasis will be found in Part II of this book.

*Bier's* hyperemic treatment, especially that form which endeavors to increase the amount of venous blood in a part, is in principle a modified phlebostasis.

### B. Bloodletting Proper

Whilst the effects of dry cupping are by no means as far-reaching as those of phlebostasis, both methods serve a good purpose in their respective therapeutic domains. It stands to reason, however, that when the bloodless methods are utilized as substitutes for actual bloodletting, when this is indicated, but where an advanced wasting disease or great debility precludes the latter's employ, their effects will never be as pronounced and comprehensive as if blood had really been withdrawn from the organism. The results of the bloody methods are more lasting, as it takes a considerably longer time until an amount of blood, equal to the original one, has been regenerated. In the meantime the inflammatory congestion may have disap-



peared. In dry cupping and phlebostasis the congestive condition is apt to return soon after the operation. Even though we may admit that the relief of the right heart and of the pulmonary circulation as well as the removal of the inflammatory hyperemia may be obtained by means of the production of an artificial hyperemia in another part with the same certainty as by actual venesection, the latter method still offers an advantage which cannot be procured by the bloodless measures. Neither dry cupping nor phlebostasis can engender an improvement in the condition of the blood as to its regeneration, for instance, as is achieved by actual venesection. Moreover, the latter also promotes the movement of the lymph so necessary in the majority of cases. Lymph stasis can necessarily be affected in a slight measure only by the dry methods, though the increased movement of the lymph provoked by phlebostasis may clinically suffice in many instances. Actual venesection will continue to hold the place which it has occupied for thousands of years and will hardly ever be replaced by the dry methods, no matter how high a stage of perfection they may attain.

The principal methods of actual bloodletting are: Scarification, wet cupping, artificial leeching, natural leeches, phlebotomy (venesection) and venepuncture.

**Scarification** is the term denoting the production of multiple superficial incisions or punctures into the skin or mucous membrane to afford relief to localized hyperemia or tension. The scarifying instrument, be it bistoury or scalpel, is held firmly between the thumb and index finger of the right hand, while the site of the skin selected for scarification, after having been carefully disinfected, is well stretched with the fingers of the left hand. The point of the instrument is thrust into the tissues to a depth of about 3 mm. (approximate).

mately  $\frac{1}{8}$  inch) and quickly withdrawn. Larger incisions are made with a convex knife right through the epidermis and subcutaneous cellular tissue with one long sweep. They should run parallel to the long axis of a limb or to the linear clefts, i.e., in the general direction of the fibers. For the reason that the blood in the capillary vessels may clot very quickly, the flow of blood induced by scarifying is often insufficient to afford proper relief of the local congestion or tension. In order to further the flow of blood or serum it is advisable to adjust dry cups over the scarified area in the manner heretofore alluded to. Warm fomentations applied to the field of operation also promote a continued oozing of blood and serum. Scarification, plus the application of cups, constitutes what is known as **wet cupping**. The technic of this method is the same as in dry cupping. The dry cups are left in position for a few minutes. Following their removal, the slightly



FIG. 11  
Convex Knife

hyperemic area is incised either with a scalpel or the automatic scarificator (q.v.) is made use of. As soon as the scarifications are made the cups are again applied. The blood will escape drop by drop into the cups. Each cup may withdraw from 5 to 10 c.c. (from somewhat more than a drachm to  $2\frac{1}{2}$  drachms) at any one time. The cups after washing may be applied again. The procedure is almost painless.

While scarification is mainly employed in the alleviation of inflammatory processes of the external and internal integuments, it may also be turned to account for the reduction of tension due to hydropic infiltration

of the subcutaneous cellular tissue, as may ensue in the extremities, scrotum and labia.

In the oral and pharyngeal cavities, where neither dry cupping nor leeches can be employed, scarification is the only available method of local bloodletting. In



FIG. 12

Bistoury Wrapped with Adhesive Plaster

order to prevent injury to neighboring tissues it is advisable to wrap the bistoury with adhesive plaster to very near its point. With this precaution, scarification of the tonsils, pharynx, uvula and glottis may be made. When there is dyspnea on the basis of edema of the glottis, the latter should be scarified at once. This, of course, should be done with the assistance of the laryngoscope, or, still better, the Hays pharyngoscope. Where the edema is most marked, incisions of from 0.5 to 0.75 c.m. in length (a little more or

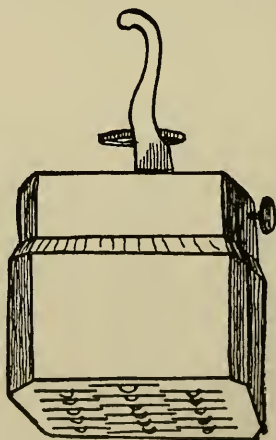


FIG. 13

Automatic Scarificator

less than  $\frac{1}{4}$  inch) are made. The oozing of blood and serum from the inflamed or edematous areas may be kept up by hot gargles or steam inhalations.

For more extensive scarifications the automatic scarificator may be employed. This instrument is cubical in form, and consists of a number (12-15) of small lancet blades housed in a brass case. By the release of a previously set spring the lancet blades shoot forth swiftly from the casing and im-

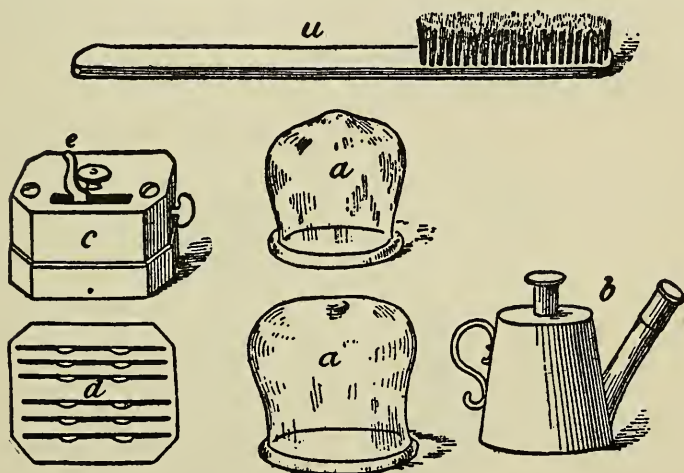


FIG. 14

## Automatic Scarificator and Accessories

*a*, Cupping glasses. *b*, Alcohol lamp. *c*, Scarificator. *d*, Capsule or case. *e*, Spring set in advance. *u*, Brush for cleaning cupping glasses.

mediately spring back again. In this manner a number of scarifications are made at one time. The scarificator should be used when more than one puncture or incision is to be made on a larger area of the skin. With the bistoury or scalpel but one puncture or incision can be produced at a time, and repeated operations inflict unnecessary pain. The depth of the punctures or incisions can be regulated by setting the

screws in the blade-holder higher or lower, or by raising or lowering the tension of the spring. The incisions may be crossed by applying the apparatus at right angles to the first incisions and releasing the spring a second time.

*Rieder* recommends the application of dry cups before and after the use of the scarificator. The scarifications react with greater energy when preceded by hyperemia, and the flow of blood is encouraged by suction of the vacuum. If the scarificator is to be applied to an extremity, the hyperemia may be induced by compression of its upper segment.

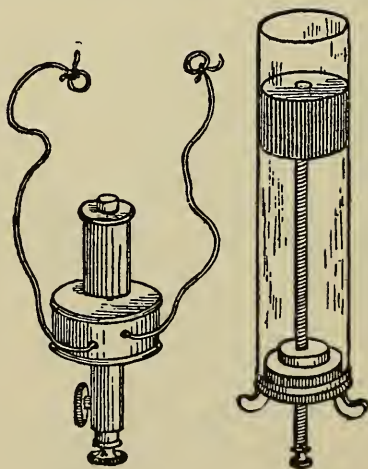


FIG. 15

Heurteloup's Artificial Leech

To simplify the procedure an apparatus, designated the artificial leech, has been constructed which combines a scarificator with a small suction apparatus, rendering the application of dry cups unnecessary. The best known instrument of this kind is the one devised by *Heurteloup*. It consists of two parts: (1) The



scarificator, which by rapid rotation of its circular lancet makes a small circular wound. The blade must be adjusted to the thickness of the skin; (2) the suction contrivance, an ordinary glass cylinder with rounded edge and air-tight piston that can be moved up and down by a thumb-screw attached to the cover of the cylinder. After the scarification has been made, the glass cylinder is applied, care being taken that no air can enter under its edge. By withdrawing the piston with the aid of the thumb-screw a vacuum is gradually created in the cylinder. As the rarefaction of the air increases, hyperemia ensues, the incised skin flap is drawn upward and the blood flows freely into the cylinder.

I take this opportunity to suggest that the two parts of the apparatus might be combined into one by simply attaching the circular scarificator to the piston in the manner that it projects to the thickness of the skin when the piston is screwed down to the lower edge of the glass cylinder. Before applying the cylinder to the area to be scarified, the thumb-screw must be turned until the circular scarifier is on a level with the edge of the cylinder. When this is in the proper position, one quick turn of the thumb-screw will produce a little circular wound. Then the piston is withdrawn in aforementioned manner.

Leeching, by which term is designated the application of natural leeches, is nowadays only employed for the purpose of local abstraction of blood from localized areas of inflammation or contusion. The medicinal leech (*Hirudo medicinalis*) is from 5—7.5 cm. (2-3 inches) long, and presents a somewhat flattened body that is greenish-black in color with reddish and yellowish spots on the back. Only fresh and healthy

leeches should be employed. They should contract when touched with the hand, should move freely about in the water, and should not have sucked blood for at least three or four months before they are used again. It takes that length of time before they have fully digested the blood, and suction ability is restored.

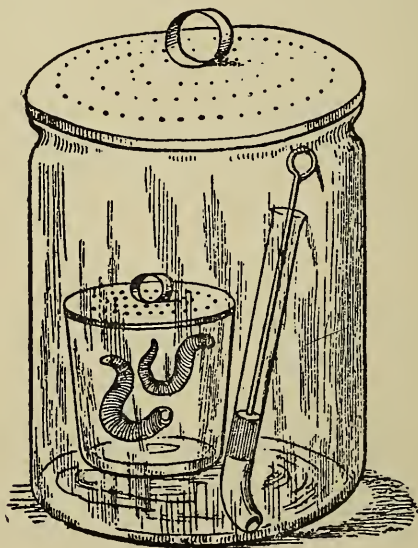


FIG. 16

Leeches, with Leeching Paraphernalia

Leeches may be kept for a considerable period in fresh water which is frequently changed. They remain in good condition when kept in a glass-jar provided with a perforated tin cover. This permits the pouring off of the water and its renewal without disturbing the suctorial parasites. The perforated cover also admits of proper ventilation.

Leeches should not be applied directly to the seat of the inflammatory process, as their bite may give rise to an additional irritation. They also should not be

“planted” directly over a superficial blood vessel or nerve, nor in areas with much loose cellular tissue, such as the eyelids, scrotum or labia. Effusion of blood into the subcutaneous tissues may ensue. Sensitive parts of the body should, of course, be avoided in leeching.

The method of applying leeches is as follows: After the skin has been thoroughly cleansed and depilated, and the leech been dried with a clean handkerchief, the animal is placed in a whiskey-glass and this applied to the periphery of the area from which blood is to be withdrawn. A test-tube or a special leech-glass may be used for this purpose; if these are at hand, the leech must be placed in the tube in such manner that its head is in contact with the skin when the container is inverted. The leech-glass consists of a glass-tube somewhat wider than the leech and a piston. When this is pushed downward the animal is compelled to crawl out of the tube. In case the leeches will not attach themselves, they may be induced to bite by swabbing the skin with milk, sweetened water or blood. The best bait, however, is fresh blood drawn by puncture or slight incision from the area to be leeches just before the animals are applied. When the oral sucker has fastened itself to the part, the animal thrusts out its jaws through its three-slitted mouth and, with a sawing movement, makes a wound of stellate triangular shape. The production of this triradiate bite causes only a slight pricking sensation. When the leech has sucked out all the blood it can hold it assumes a certain degree of rotundity, and generally drops off of its own volition. If this be not the case, sprinkling a pinch of salt over the animal, or moistening the skin around the bite with salt water or vinegar, will induce the leech to relinquish its hold. Forcible removal must

be avoided, as it causes pain to the patient; neither should the leech be pricked with a needle, as this would spoil it for future use. Leeches cannot bite through the thick epidermis of the palm of the hand or the sole of the foot. If it is necessary to apply leeches about the orifices of the body into which they might crawl, they must be secured by threads. Should they, however, through carelessness find their way into the auditory canal, or into the vagina, rectum, etc., they should be dislodged or killed by the injection of a moderately strong salt solution.

Leeches offer the advantage that a comparatively large amount of blood may be withdrawn from a very small surface of the skin, and that they may be applied, save aforementioned exceptions, to almost any external part of the body. There is one drawback, however, namely, that it is difficult to determine the loss of blood with accuracy. A leech weighing from 2 to 3 grams ( $\frac{1}{2}$  to  $\frac{3}{4}$  drachm) is able to abstract from 5 to 10 grams ( $1\frac{1}{4}$  to  $2\frac{1}{2}$  drachms) of blood. After the leech has dropped off, it is often desirable to prolong the flow of blood. By the application of hot fomentations the flow is usually excited so that as much as 30 c.c. (1 ounce) may be withdrawn through each leech-bite. As a rule, the bleeding ceases spontaneously; if this be not the case, compression or cauterization should be resorted to when the usual hemostatic means have failed.

*Weil* has made some very interesting experiments concerning the abstraction of blood by leeches. He discovered that the often profuse and rather obstinate bleeding after the removal of the animal, is caused by a specific secretion emanating from the leech that impedes coagulation of the blood. The nature of this coagulation-preventing substance has not as yet been

determined. Experiments, however, have shown that fresh blood placed in an open glass will not clot, despite the free access of air, when leeches are put into it.

This may lead to the conclusion that when small amounts of blood are to be withdrawn, cupping or scarification are preferable, because the bleeding may be stopped at a moment's notice. On the other hand, for the abstraction of larger quantities of blood, neither of these two methods is well suited, as they allow of only insignificant withdrawals. Leeches are certainly to be preferred for local depletions of 30 c.c. (1 ounce), or more. They may even be utilized in place of venesection, except in cases where a quick removal of 300, 500, or more grams of blood is imperative, as, for instance in pneumonia with impending failure of the right ventricle, acute uremia, etc.

By phlebotomy or venesection is understood the opening of a superficial vein for the purpose of withdrawing blood from the circulation. It is scarcely necessary to remind the reader that the opening of an artery, i.e., arteriotomy, is hardly ever made nowadays, though it still has some strong advocates who claim that it causes a more energetic and direct depletion, especially of the cerebral circulation, than can be accomplished by opening a vein.

If phlebotomy is to be performed, the following instruments and accessories should be in readiness: a scalpel and a sharp-pointed bistoury, a piece of strong rubber-hose 50 cm. (20 inches) long and 1 cm. ( $\frac{1}{3}$  inch) in diameter, some bandages and sterile gauze pads, and a few vessels for receiving the blood, one of which should be a glass graduate of not less than 500 c.c. (1 pint) capacity. It goes without saying that all instruments and accessories, the hands of the operator and the arm of the patient must be surgically clean.



Phlebotomy is performed in the bend of the elbow by the temporary opening of one of the local subcutaneous veins. As a rule, the basilic vein is selected, but personally I prefer the cephalic vein for reasons which I will explain hereafter. It is advisable to make a careful preliminary survey of the field of operation as regards the course of the arteries and the location and distribution of the veins. In order that the veins

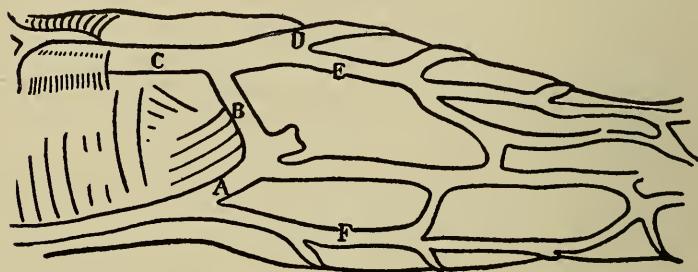


FIG. 17

## The Superficial Veins of the Forearm

A, Median cephalic. B, Median basilic. C, Basilic. D, Posterior ulnar. E, Anterior ulnar. F, Radial.

stand out prominently a bandage is generally applied around the patient's arm above the elbow. This is even better accomplished by placing aforementioned rubber-hose about the arm. Care, however, should be taken that the compression is of a degree that the radial pulse is yet palpable. In my personal work I prefer the von Recklinghausen cuff, which is inflated by an assistant, whose duty it is to regulate the compression in such a manner that only the superficial veins, and not the arteries, are obstructed. The moment the arteries become compressed, the wrist pulse will be lost to the touch. If the veins do not stand out sufficiently prominent, exercise of the fingers while the arm is hanging down, or grasping something and try-

ing to close the hand forcefully, or making a tight fist will accomplish the desired end.

The patient should be in a recumbent or sitting posture; the arm selected for the operation should be turned outward and rest comfortably on a firm support. It is best if an assistant keeps it in a fixed position. The operator holds the arm with the left hand in such a manner that the thumb is placed upon the vein just below the spot where the incision is to be made. The scalpel or bistoury is held between the thumb and index finger of the right hand which rests upon the arm of the patient, and its point is thrust into the vein. The incision should not be made parallel to the long axis of the vein, as the cut thus produced may not permit the escape of a sufficient amount of blood.



FIG. 18

Showing Fixation of Vein by the Thumb

Both the longitudinal and the circular fibers of the vein must be severed, and this is accomplished by a cut running at an oblique angle to the long axis of the blood vessel. While the incision is being made great care must be exercised that the skin does not slip from beneath the thumb of the operator, as the cut in the skin must exactly correspond in size and location with that in the vein. If this is not the case, the flow of blood will be either impeded or be directed to the subcutaneous structures. Moreover, the operation, whenever possible, should be made at one cut; in obese persons,

however, it may be necessary to make two or even three incisions. The length of the incision should be about  $\frac{1}{2}$  cm. ( $\frac{3}{16}$  inch), so that the blood may freely escape as the thumb releases its hold. If the cut should not prove sufficiently long, the bistoury should again be inserted and the incision extended by raising the bistoury-point, slitting open the anterior wall of the vein from within outward.

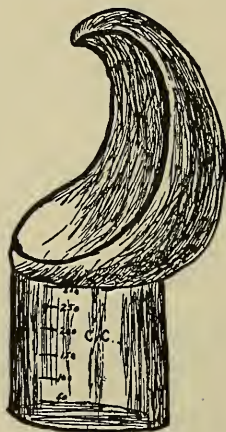


FIG. 19

Special Phlebotomy Vessel

The flow of blood is encouraged by grasping movements of the hand, or by instructing the patient to support himself by the arm operated upon on a walking stick. The blood is caught in a glass-graduate or in a special phlebotomy vessel that is also graduated, and the exact amount withdrawn must be known to the operator at a glance. The amount to be abstracted depends not only on the body weight, but also the constitution of the patient. Speaking quite generally, an average of from 3 to 5 grams of blood per kilogram of body weight is the largest amount that may be with-

drawn with impunity at one time.\* Of course, one may occasionally be confronted with cases that, in order to attain complete success, demand a depletion of two or even three times the quantity.

When the amount of blood abstracted seems sufficient, the compression bandage is removed by an assistant while the operator firmly holds a sterile gauze pad to the field of operation. After this the wound, which heals within a few days, is dressed with an aseptic or antiseptic gauze compress, that is secured by a bandage or by adhesive strips.

It will occasionally happen that the knife misses the vein. In this case another incision must be made, or, as in very fat persons, the vein is laid bare by a cutaneous incision, after which the vein itself is incised. If the skin be drawn away so that the cut in it does not correspond with that in the vein, and the blood is discharged into the subcutaneous cellular tissue, the operation should be interrupted, the wound closed by compression, and venesection be performed on the other arm. The extravasated blood is absorbed within a few days if infection be prevented, which in these days of asepsis and antisepsis is a self-evident necessity. In patients affected with diabetes or other cachectic diseases, extravasation of blood or injury of the adjacent tissues must be strictly guarded against, as a skin-gangrene is liable to be produced. While, as a rule, the gangrenous process remains of a superficial nature and does not spread to any extent, it may take weeks before healing takes place. If not absolutely necessary, I would advise that neither venesection, nor even venepuncture or an infusion be made in patients of this class. Injuries to the nerves, due to phlebotomy,

\*Hereafter the amount of blood withdrawn is stated in cubic centimeters and not in grams, as it is generally not weighed, but directly measured in the graduate into which it escapes.

are rather negligible occurrences, as the functional disturbances of the cutaneous nerves are invariably slight, disappearing, as a rule, with the healing of the wound. It is hardly necessary to point out that, if the patient should faint and the bleeding cease, the operation must at once be interrupted, the compression bandage loosened, and the head of the patient lowered. A general anesthetic is usually contraindicated where venesection is indicated, and a local anesthetic is hardly ever necessary. In case the patient is hypersensitive, the field of operation may be frozen with ethyl chlorid.

In certain cases, venesection should be immediately followed by an infusion of a saline solution. The technic of the latter is simple enough, but it is more rational to combine an infusion with venepuncture, as will be shown hereafter.

The spring-lancet and fleam, the insignia and chief tools of the barber-bleeders of our grandfathers' time, are only mentioned in this connection to be condemned. No doubt, the phlebotomania of the seventeenth and eighteenth century was to the greater part due to these devices which were for sale in every town. Everybody could secure an instrument for domestic use. In these days of surgical asepsis, the spring-lancet is only found on the shelves of the medical curio cabinet.

I believe it was I who first employed the expression **Venepuncture** in American medical literature. For upward of fifteen years I have taught and demonstrated this method of bloodletting for therapeutic purposes. By venepuncture I understand the direct insertion of a needle or a trocar into a vein for the sake of withdrawing blood or for the intravenous introduction of saline solutions or other remedial agents. Since the advent of the complement-fixation tests, and still



more so since the commercial exploitation of the Ehrlich-Hata arsenical preparations, venepuncture enjoys a popularity that nobody dreamt of but a few years ago.

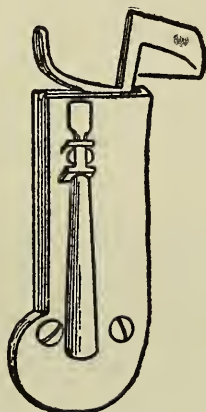


FIG. 20  
Spring-lancet

The advantages of venepuncture over venesection are: Greater simplicity, greater safety for both patient and physician, greater cleanliness, more rapid accomplishment of the purpose, possibility of immediate intravenous saline infusion after abstraction, and rapid and uneventful healing of the small puncture

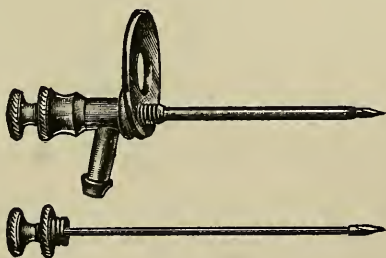


FIG. 21  
Stern's Trocar

wound. Originally ordinary long hypodermic needles were used in venepuncture, later Strauss devised a special needle for this purpose. This needle is nothing else but an aspirating needle, to the cannula of which a small handle is attached vertically. The needles mostly employed nowadays are but modifications of the Strauss device. The venepuncture instrument first described by me about ten years ago is constructed on the principle of the trocar which, when in situ, with withdrawn perforator, cannot injure the blood vessel

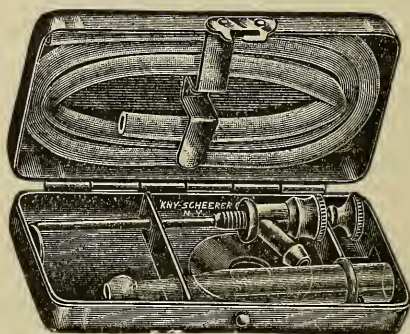


FIG. 22

Stern's Trocar and Accessories in Case

or penetrate it on the other side as any needle is apt to do. Besides this, it exhibits various other advantages which will be readily appreciated when perusing the description.

The entire instrument is 7 cm. (3 inches) long. The cannula alone measures 4 cm. ( $1\frac{5}{8}$  inches) in length. The perforator, entering the cannula, is of steel, heavily nickel-plated. Cannula and perforator are manufactured in three different sizes, i.e., diameters. The thumb-rest is in the shape of a ring, which may be readily detached. The outlet, which is to be connected with a rubber tube, is at the side of the

thumb-rest when the latter is in situ, so as to interfere as little as possible with the operator. The perforator can be withdrawn far enough to permit passage of the blood through the outlet. This outlet serves also as the inlet for a saline infusion.

In an aseptic case together with the trocar are packed (1) a piece of narrow rubber tubing fitting into the outlet of the instrument, and (2) a connecting tube made of glass, which is to be attached by its wide end to the tubing of the irrigator containing the solution to be infused, while the narrow end is made to fit into the narrow rubber tubing leading from the outlet.

Mode of employment.—After the arm is corded as for venesection (a piece of rubber tubing as already described being well adapted for the purpose), and the part is properly cleaned, the handle or thumb-rest of the trocar is held between thumb and index finger, while the middle finger rests against the handle of the perforator to prevent the latter from sliding backward. The operator then thrusts the trocar directly into the most prominent vein in the bend of the elbow—the right arm if possible. The puncture is made so that the point of the trocar is toward the axilla, and although the instrument points in the same direction as the blood current, the blood escapes readily when the perforator is withdrawn beyond the outlet. The piece of rubber tubing packed into the aseptic case should be attached to the outlet before the trocar is introduced into the vein. This rubber tubing should lead into a graduated glass vessel in order that the operator may quickly ascertain the amount of blood withdrawn. Immediately after depletion, when the cannula is still in position, an infusion may be administered through the same tubing and outlet. All that there is to do to accomplish this purpose is to free the connecting tubing

from coagulated blood, and to attach it to the tubing of the irrigator containing the solution to be infused by means of the specially constructed glass connecting-tube accompanying the instrument, and to remove the compression bandage or the rubber tubing used for cording. If the withdrawn blood has a tendency to rapid clotting, it is advisable that a second small rubber tube be on hand to replace the one through which the blood has escaped if an infusion is to be made.

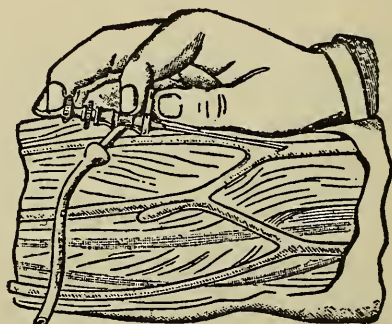


FIG. 23

Illustrating Mode of Introduction of Stern's Trocar into the Cephalic Vein

The chance of injuring nerves and arteries is reduced to a minimum by inserting the trocar into the cephalic vein, which is not situated in as close proximity to these structures as the median basilic, which is the vein generally chosen for venesection. The vein in either arm may be punctured; however, if the vein of the left arm is not more prominent, it will be found more convenient to needle the cephalic vein of the right arm. The chance of admitting air into the vein when employing this trocar is entirely eliminated; a needle may possibly permit the entrance of air, a trocar constructed like the one described absolutely precludes this. The perforator cannot be withdrawn beyond the

outlet; when the perforator and the cannula are to be cleansed and sterilized, the instrument has to be taken apart, which is readily accomplished by releasing the screw forming the handle of the perforator. Venepuncture and subsequent needling of the vein may be accomplished in about 95 per cent. of all cases in which depletion is to be performed. Only in cases when the arms are very fat or when on account of edematous swellings the course of the vein cannot be recognized, is it necessary to resort to venesection. Compression should be sufficient so that the veins stand out prominently, but not to the extent that the radial pulse be suppressed.

In the adult, bloodletting by venepuncture is one of the simplest operations imaginable. It is readily performed by any physician after he has had some experience with it. I have as yet to hear the first objection to its employment by the patient or his relatives. It is my firm belief that venepuncture will inaugurate a new era of the almost entirely forgotten ancient practice of bloodletting. The simplicity of the procedure will make bloodletting again a favorite and highly lauded therapeutic factor, and it may readily happen that certain practitioners will bleed every case that comes for treatment, whether it is indicated or not. Although I do not in the least doubt that bloodletting by this modern method will be grossly abused, as is the case with all new or resuscitated therapeutic measures, I am, nevertheless, convinced that the great import of depletion in the suitable cases will be more and more recognized and appreciated by the trustworthy, biologically thinking physician.

The infusion of a sodium chlorid solution or the transfusion of blood has really nothing whatever to do with bloodletting, and they are only mentioned on



this occasion, as their performance necessitates either phlebotomy or venepuncture. This book, it must not be forgotten, does not deal with something that is to be added to the body, but with something that is to be withdrawn from it. Inasmuch as this is a monograph on the theory and practice of bloodletting, and nothing else, I do not refer therein to any other therapeutic measures that may be called for besides the depletion. Infusion has only been mentioned as a complementary expedient of bloodletting. An ideal method of administering an intravenous infusion is by means of Stern's trocar, as the blunt cannula, when in situ, cannot penetrate the other side of the vein, and pain as well as extravasation of the infusion fluid into the surrounding tissues are entirely precluded. In cases where both bloodletting and a saline infusion are indicated, it may be of advantage to perform both procedures simultaneously. That is, two trocars are being made use of at the same time; one is introduced into the median cephalic vein in one arm, the other into the same vein in the opposite extremity. The simultaneous performance of both procedures may allow of an abstraction of larger amounts of blood than is safe to withdraw when the operations are performed successively, i.e., first the depletion and then the infusion.

## **PART SECOND**

**SPECIAL CLINIC OF LOCAL AND GENERAL  
BLOODLETTING**



## INTRODUCTORY REMARKS

From the experimental studies concerning loss of blood and bloodletting, the following facts of import in therapy have been established:

1. Bloodletting relieves the heart by temporarily decreasing the volume of blood and causing it to become diluted by the access of fluid from the lymph channels. This is equivalent to a decrease in friction-resistance in the circulation.

2. The lymph stasis is alleviated, and in consequence thereof the general metabolism is accelerated.

3. Hydremia and improvement of the circulatory conditions ensuing after bloodletting encourage increased urinary secretion.

4. After depletion, it is the tissue fluids which are present in excess (for instance in the lungs) that are first taken up by the blood.

5. By means of bloodletting poisonous substances may be directly removed from the body, the elimination of which by the excretory organs would occupy such a long time as to imperil the entire organism.

6. Bloodletting acts as a stimulant of the regenerating function of the hematopoietic organs, particularly the bone-marrow.

7. The main object of a sodium chlorid infusion after loss of blood is to support the action of the heart until a sufficient amount of blood has been regenerated.

8. According to the nature of the case, the following indications of bloodletting may present themselves: Changes in the amount of blood, in the distribution of the blood, and in the condition of the blood, or any two or all the three indications together.

9. Dry cupping changes the distribution of the blood by giving rise to a local congestion of the superficial structures, thereby mitigating congestion of deeper situated organs.

10. By phlebostasis a certain quantity of the blood is withheld from the general circulation without entailing actual loss of blood.

11. Wet cupping and the other methods of local depletion are only to be considered in a comparatively narrow field of local affections belonging to the domain of "minor surgery" and certain specialties.

12. Only general depletion meets all the indications for bloodletting which is best performed by venepuncture.

13. The therapeutic effects of depletion are most strikingly noticeable when general bloodletting has been performed. This will be gleaned from the following chapters, which are almost entirely based upon clinical experience. Where no special reference is made it should be understood that general bloodletting is always meant. I have selected the most important of the graver systemic diseases in which general bloodletting is indicated. The judgment of the attending physician must determine how and when in similar and other cases venesection is to be applied.

The classification of the diseases has been made from a wholly practical point of view. A strictly scientific differentiation could not be adhered to if only for the reason that the symptoms demanding depletion may be encountered in a variety of affections. Moreover, it would be difficult to draw definite lines of demarcation between certain disease-states which belong simultaneously to several domains of pathology, such as uremia, chlorosis, pneumonia, etc.



## I. DISEASES OF THE RESPIRATORY ORGANS

Although this little book is written for physicians who call a certain amount of pathological knowledge their own, still I deem it wise to complete the various disease pictures by a short exposition of the pathogenic points of view as presented by the science of today. The practitioner will be best served if he culls from the bewildering variety of opinions that which forms the basis of present day therapeutic interference. Fortunately, we need not grope any longer in the dark. The days are past when the derisive remarks of Mephistopheles (in the scene with the studious Wagner) on the impotence of medicine were justifiable:

“Der Geist der Medizin ist leicht zu fassen:  
Ihr durchstudiert die gross’ und kleine Welt,  
Um es am Ende geh’n zu lassen—  
Wie’s Gott gefällt.”

The gist of medicine is quickly grasped:  
You scrutinize all things, both great and small,  
And leave it then, with hands unclasped—  
To God, who knows it all.

Experimental investigations and clinical observation furnish general lines of direction for the guidance of therapeutic management. This is of special importance as regards artificial bloodletting. A therapeutic method which has so many enthusiastic adherents, and likewise a host of determined opponents, must needs rest upon a pathological basis which brings indications and contraindications into prominent relief. I begin

with pneumonia, the acute inflammation of the pulmonary parenchyma. Although this manifests itself in different forms which represent, etiologically as well as clinically, particular groups of disease, yet, so far as bloodletting is concerned, the various pneumonias may be looked upon as the result of one and the same pathological process. Right here I wish to emphasize that venesection in pneumonia is still as effective today as it was in its palmy days, and that the ancient physicians were only mistaken about the causes of the beneficial effects, and certainly not about the beneficial effects themselves.

### A. Pneumonia

Since ancient times pneumonia has been the one disease which was considered to be particularly amenable to treatment by artificial blood abstraction. Physicians as well as laymen had such strong faith in it, that, as has already been mentioned in the historical retrospect, so late as the beginning of the nineteenth century a surgeon had been charged by the courts with murder, because he had neglected to perform venesection in a fatal case of croupous pneumonia, when in the opinion of a great medical authority the life of the patient could have been saved by this operation.

An entire change of front, however, has occurred since venesection has lost its prestige as an antiphlogistic. Since it has been established that inflammation is caused by the so-called pathogenic microorganisms and that these cannot be eliminated from the system by means of bloodletting, this has been banished from the therapeutics of pneumonia as an apparent useless procedure. The purely empirical fact—proved innumerable times—that the prognosis of pneumonia is more favorable with, than without bloodletting, was no

longer accepted. As its action could not be adduced to antiphlogosis, and another explanation was not at hand just then, the employment of phlebotomy in pneumonia was simply stopped. I cannot refrain here from the remark that the list of our therapeutic agents would have to be appreciably curtailed if we were to employ only such drugs or remedial measures the exact pharmacological or physiological action of which is established beyond all doubt. To wait until the scientific status of a remedy is definitely settled would in many instances constitute a wrong to the patient, who seeks health and cares little whether he gains it by rational or purely empirical treatment.

That bloodletting, although it yields no antiphlogistic effects, is, nevertheless, a rational therapeutic factor, has only been established in recent years. In truth, it should have been known in Harvey's time, for with the discovery of the circulation not only physiology, but also pathology was put upon a new foundation. And as pneumonia has always been one of the most frequent as well as one of the most dangerous diseases, it certainly seems self-evident that the revolutionary discovery of this great Englishman should have been applied to the pathogenesis of this dreaded affection. Unfortunately this was not the case. It was left to recent times to draw the proper conclusions in respect to pneumonia. Bloodletting was thus rescued from unmerited oblivion and again acquired recognition in the realm of therapeutics.

Today we know that bloodletting does not in any manner influence the inflammatory process, but that it removes the venous engorgement in the lesser circulation in a mechanical way and averts pulmonary edema when performed at the proper time. The reaction is neither of an antiphlogistic nor a disinfecting charac-

ter. By the abstraction of blood neither the causative factors of pneumonia nor their toxins are removed from the body, and no such effects are claimed for bloodletting in any other infectious process. But phlebotomy affords relief to the heart, the action of which is more or less embarrassed by the pulmonary edema. It is not a specific against pneumonia and cannot arrest its course. It can only remove the obstructions produced in the pulmonary circulation by venous congestion and edema, and in this, when applied at the proper moment, lies its life-saving quality, as *Pal* and other authors have testified. Their testimony is borne out by my own clinical experience.

The enthusiasm with which bloodletting is practised nowadays in pneumonia in its divers forms and complications is proved by the vast, almost illimitable amount of modern literature on the subject. Of course, there are still some sceptical minds arrayed against the advocates of depletion. Perhaps there is some advantage in this. Even though a few isolated expressions against bloodletting may be heard here and there, they can hardly weigh heavily in the balance in the presence of the overwhelming majority of its supporters; and, after all, substantial, authoritative criticism always bears good fruit. It points out mistakes, determines indications and contraindications, and, above all things, prevents a relapse into the deplorable depletion-excesses, which in the historical preamble were branded as "vampirism."

*Pempry's* and *Guerber's* laboratory tests have demonstrated that a severe loss of blood, whether with or without subsequent transfusion, does not cause any decrease in the respiratory exchange, provided the experiment animal is kept in a proper state of nutrition after the operation. However, the animal after a great

loss of blood no longer has so great a reserve store of energy.

*Packard* has observed that dry cupping in the earlier stages of pneumonia and pulmonary congestion from various causes, removes the sensation of pain and oppression and promotes deeper and fuller respirations. Many physicians, especially in America, have never entirely banished dry cupping from their private or hospital practice, and have obtained, on the whole, the same favorable results from its application in pneumonia patients as the aforementioned author.

*North* ascribes but a problematical value to depletion in pneumonia on the ground that the two most menacing symptoms of the disease, the dyspnea and the pyrexia, are only temporarily alleviated, and that they both tend to return in a few hours. While he practically admits that bloodletting affords relief in the stage of engorgement by reducing the volume of blood passing through the lungs, he claims that the same result may be attained by ligating the extremities, with the advantage that there would remain the full amount of blood and that the patient be not debilitated. In the later stages of the disease, he maintains, bloodletting is absolutely contraindicated. He concurs with other observers when he states that the withdrawal of blood does not shorten the course of pneumonia, and that the patient is better served if his strength is maintained than by abstracting his blood. What this author, therefore, approves of is essentially phlebotasis. I admit that phlebotasis is a suitable remedial procedure in many cases, especially when the right heart is not too much overworked. But when it becomes imperative that a larger volume of blood be withdrawn from the circulation, and that the effects of this endure for at least a number of hours, bloodletting



alone is indicated. We must not forget that by a moderate phlebotomy (the only permissible application in a feverish patient at the height of the disease) a rather insufficient amount of blood is withheld, whilst a fulminant pneumonia in a phlethoric patient often necessitates the abstraction of 500 or more c.c. of blood.

*Gilbert*, maintaining the standpoint of *Finly*, is more kindly inclined toward bloodletting and warmly advocates its employ in the earlier stages of the disease. He recommends bleeding freely in the first twenty-four hours, provided the constitution of the patient is unimpaired, and when the disease is attended by inflammatory fever, or symptoms are threatening, but not with exhaustion, yet in which the onset of the disease is rapid.

*Perry* deals with the question in a practical manner. He looks upon pneumonia as essentially a disease in which life may be saved and distress much relieved by a timely bloodletting. He distinguishes three types of pneumonia in which venesection may be used to advantage:

1. In the early stages of cardiac failure.
2. In pneumonia complicated by considerable acute bronchitis.
3. In plethoric pneumonia.

Ad 1. Bloodletting is only of real therapeutic value in those cases in which the heart still has a good potential vitality. If cardiac debility is already of a marked character, bloodletting will be but a palliative measure, especially when the failure occurs early in the disease. In the favorable cases of acute pneumonia the pulse is full and fairly soft. There is, however, often a large, vehement pulse with a well-marked diastolic murmur. In unfavorable cases of the disease a variety of pulse may be present. When a failing heart is

associated with a high blood pressure, the latter is presumably the chief factor in the causation of the failure. However, where the myocardium has primarily been weakened by toxemia or pyrexia, the pulse is likely to be small and feeble, although this may also be the result of the bad effects of high pressure pulse. It is self-evident that an abundant abstraction of blood affects each pulse-variety in a different manner. High blood pressure is lowered and softened while the small and feeble pulse becomes fuller and increases in tension as the withdrawal of blood relieves the heart and the overburdened venous system.

Ad 2. In cases of pneumonia early complicated with bronchitis, profuse expectoration is decidedly improved by bloodletting. This, however, should be undertaken at an early stage of the disease and not delayed until cardiac failure has supervened. In old and weak persons depletion is always contraindicated.

Ad 3. By the term plethoric pneumonia *Perry* understands a familiar type. The patient is stout and is considered a robust man by the lay mind. He has a high blood pressure and generally suffers much pain and distress, especially in the first stages of the disease. Patients of this type are overfond of food and drink; they may, however, be saved from the grave by an abundant blood abstraction despite an apparently unfavorable prognosis. That the term "plethora" signifies as a rule rather an unequal distribution than an augmentation of the total blood-volume, I have shown in another chapter of this monograph. Of pleuro-pneumonia *Perry* makes no mention. But also in this type of pneumonia, especially when extensive exudation and empyema formation still further aggravate the pulmonary congestion, general bloodletting, unless interdicted by particular circum-

stances, may prove a rational and efficient adjuvant of pleurocentesis.

*Waterman* reports eight apparently hopeless cases of pneumonia which were treated by bloodletting and the intravenous infusion of a saline solution. In five cases complete recovery ensued; the remaining three cases succumbed after temporary improvement, because of complications (twice on account of nephritis). He is of the opinion that the saline infusion diluted the toxic blood, and possibly acted as a stimulant to the heart and other organs. In all his cases the infusion was followed in about two hours by a chill of varying severity. All but one infusion were followed by a profuse sweating and fall in temperature. The amount of blood withdrawn varied in the different cases from 225 c.c. to 600 c.c. ( $7\frac{1}{2}$  to 20 ounces). One patient was bled on two occasions and altogether 870 c.c. (29 ounces) of blood was abstracted from him. The improvement in one of *Waterman's* cases is so plainly ascribable to venesection and perhaps also to the subsequent saline infusion that its description may not be out of place here.

The patient was a man, 35 years old. His previous medical history was negative. He had a chill the previous day, with pains all over the body, and a sharp pain in the right side. There was present severe cough, with bloody expectoration; also high fever and prostration. The cheeks were flushed, the tongue moist and coated. He was then not delirious. The heart was rapid and weak; no murmurs could be heard. There was dulness, with slight bronchial voice and breathing, and subcrepitant râles over the right base. There were no abdominal symptoms. The sputum was rusty; the cough moderate. The temperature was 104 deg. F., the pulse 116, and the respirations 28 per minute. The

urine was dark amber, acid, and contained no albumin. On the sixth day of his illness the patient's face was dusky, the eyes bright and peering constantly into every corner of the room or throwing a quick glance at the window. He was very delirious, and thought that he was being pursued. (This is the type of patient that must be constantly watched, so that they do not throw themselves out of the window.) His temperature was 103 deg. F., the pulse 138, the respirations 40. The entire right side showed signs of consolidation. He looked like a person who was rapidly nearing the end. Although his pulse was rapid, but not bounding, it was of fair tone. The author felt that venesection and an intravenous infusion would give the patient his only chance to live. At 12 o'clock 420 c.c. (14 ounces) of blood were removed from the median basilic vein and 480 c.c. (16 ounces) of normal saline solution injected. About two and one-half hours afterwards, the patient had a severe chill and his temperature rose. The pulse became rapid and weak, and signs of pulmonary edema manifested themselves. At 4 o'clock, the temperature had risen to 106 deg. F., and the pulse to 170 per minute. The patient was apparently in collapse. He reacted well to stimulation, a free perspiration appeared, and at 6 o'clock the temperature had declined to 101 deg. F.; the pulse to 146, and the respirations to 36. At 10 o'clock, the temperature was 99.5 deg. F., the pulse 110, and the respirations 30. The delirium had entirely disappeared. On the following day the temperature fluctuated between 101.4 and 102.6 deg. F., the pulse between 112 and 120, and the respirations between 32 and 34. On the second day after the bloodletting, signs of consolidation appeared in the left upper lobe, but at no time did the symptoms become alarming. The patient's tempera-

ture became normal eight days after the blood had been withdrawn.

The collapse in this case was so marked, the temperature so high, the heart so rapid and weak, and the edema and general condition so alarming, that it did not seem possible for the patient to recover. The patient's condition before the venesection and intravenous infusion was simply hopeless. An interesting thing in this case was the immediate restoration of the patient's normal mental condition upon the fall of the temperature.

According to *Pal*, bloodletting should be resorted to as soon as the patient shows definite signs of dyspnea, when his breathing is difficult and labored, when he is strongly cyanotic and his face congested, when the veins in the neck are distended, the right heart dilated, and the pulse small and tense. As an immediate effect of bloodletting, the tension becomes relaxed, the breathing becomes freer, the carbon dioxid surcharge of the blood is removed, and, as a result thereof, the cyanosis is obviated. Still more is accomplished by bloodletting in imminent or already established edema of the lungs which, on account of the compression of the capillary blood vessels and the choked condition of the pulmonary vesicles, blocks the air passages, impedes the inspiration of oxygen and the expiration of carbon dioxid, and thus invites the danger of suffocation.

*Pal* objects to early venesection, as he maintains that its effects should last until the crisis has supervened; but it should be performed before the pulmonary edema has ensued and the cardiac weakness has attained a degree when the relief afforded by the removal of the obstructions in the lesser circulation can be of no further avail. Employed at the proper time



bloodletting together with a saline infusion has saved many a life. The keen, diagnostic glance of the experienced physician will quickly discern the right moment and thus may forestall the necessity of a second bloodletting which is sometimes not entirely bereft of a certain degree of risk. The fact that the blood be withdrawn shortly before the pneumonia-crisis sets in, does not imply that the inflammatory process be removed nor even shortened. The import of bloodletting, the same author declares, depends upon the circumstance that it enables the organism to last throughout the course of the disease.

Prompted by results obtained in animal experiments, *Strubell* prefers arteriotomy to phlebotomy in cases of pulmonary edema. He points out that the elasticity of the lungs permits them to accommodate a much larger amount of blood than is normally contained in them. However, it should not be lost sight of that the arterial blood is not only more valuable to the body, but also that the detoxication from carbon dioxid surcharge, which latter is invariably present in pulmonary edema, is undoubtedly more quickly accomplished by venesection or venepuncture than by arteriotomy.

*Pye-Smith* states that blood should be abstracted for the relief of the right heart in the presence of pulmonary obstructions, in cyanotic and related conditions, and when a small, feeble pulse obtains. *West* contends that a patient with pneumonia should not be bled if it can be avoided, but that conditions may arise, as rapidly increasing cyanosis and failure from overdistension of the right heart, when bleeding will really be the only means of saving life. This writer agrees with many other authors that pulmonary congestion—the most dangerous stage in pneumonia—can by no

other measures be so promptly relieved than by blood-letting. If bleeding is unnecessary it must be harmful, he continues, for cardiac asthenia is one of the chief dangers, and the risk of it is increased by bleeding. *Ogle* reports a case of pneumonia in which bloodletting proved a life-saving procedure. The patient, a man 33 years old, was unconscious and in a moribund state when 1000 c.c. (30 ounces) of blood was abstracted. Improvement was very marked; consciousness returned, the pulse became fuller and slower, and the respiration freer. The same author asserts that blood-letting is invaluable for the relief of the right heart. *Mackenzie* relates that he had been called in consultation to see a case of pneumonia in a woman previously healthy and strong. He found her cyanotic, with pulse 126, temperature 104 deg. F., and respirations 52. The patient was drowsy and apathetic. Venesection was performed and 850 c.c. (28 ounces) of blood withdrawn. The following morning the temperature had fallen to 98 deg. F., but in the evening it had again risen to 104 deg. F. The next day the condition of the patient was desperate; she was unconscious, with a pulse of 103, temperature 105 deg. F., and respirations 80. The withdrawal of another 375 c.c. (12 ounces) of blood caused immediate improvement. The most urgent symptoms subsided, and the patient completely recovered.

The first venesection I ever performed was on a full-blooded young man who was apparently mortally ill with pneumonia. The patient, whom I had been called to see in consultation, had a respiration-pulse rate of 1:1.7, was profoundly cyanotic and in a condition of extreme cardiac weakness. The right ventricle was very much enlarged, and epigastric pulse had made its appearance, the diastole was markedly shortened and

the second pulmonic sound could not be elicited. The removal of about 800 c.c. (26 ounces) of blood brought immediate relief and improvement. The patient made an uneventful recovery. *v. Jaksch* regards bloodletting as a measure of last resort in instances of pneumonia characterized by undue retention of carbonic acid and a small, hard pulse. He relates the case of an extraordinary vigorous wet-nurse with a bilateral pneumonia which was accompanied by cyanosis and dyspnea of the utmost degree. Abstraction of 250 c.c. (8 ounces) of blood relieved the distressing symptoms. "I am convinced," he says, "that bloodletting has saved this patient; this was the gravest case of pneumonia which I have seen to recover, and it is my firm belief that it was due to the venesection." *Catola* maintains that blood abstraction during the period of hepatization facilitates the absorption of the collateral edema. He advocates bloodletting in pneumonia under all conditions, excepting only marantic old people and atheromatic and anemic individuals. *Jürgensen*, formerly an opponent, now looks with favor upon venesection in pneumonia. But he deems the withdrawal of 200 to 300 c.c. (6 to 10 ounces) sufficient; he discounts a repetition of the operation because the decrease of red blood cells goes hand in hand with a proportional decline of blood oxygen. The favorable influence of venesection never endures longer than twenty-four hours, and the procedure merely encourages the circulatory functions so that a natural termination of the disease may ensue. However, *Jürgensen's* contentions anent the loss of erythrocytes are, to say the least, antiquated, for *Snapper's* observations, referred to in a previous passage, have clearly demonstrated that the red blood cells are not only quickly regenerated, but are also en-

dowed with a greater power of resistance than their predecessors.

It is *Korányi's* experience that bloodletting promptly alleviates the alarming symptoms of pneumonia. The phenomena indicating abstraction of blood, according to this author, are: Intense pulmonary hyperemia with or without edema; serious dyspnea; cardiac embarrassment, especially of the right ventricle; much accentuated pulmonic sounds; engorged jugular veins; strongly pulsating carotids; flushed or bluish-red cheeks, and great activity of the respiratory muscles. According to the amount of the blood forced through the hyperemic and inflamed lungs, the pulse may be either hard, strong or weak.

*Loomis*, who was of the opinion that bloodletting in pneumonia must do harm, nevertheless admits that free bleeding gives prompt relief when the patient is vigorous and there ensues "a sudden engorgement of the heart with blood, attended with all the signs of sudden and extensive pulmonary edema and congestion." According to this author, who was at the zenith of his activity more than twenty-five years ago, 300 c.c. (10 ounces) of blood is the maximum amount that may be abstracted. *Fowler* makes the following statement: "Cyanosis and signs of overdistension of the right side of the heart with epigastric pulsation and prominence of the jugular veins and a small and irregular pulse, are indications for venesection, and relief is generally given when 180 to 250 c.c. (6 to 8 ounces) of blood has been withdrawn. The improvement is perhaps most obvious in cases accompanied by or following bronchitis, but unfortunately it is as a rule of only short duration."

*Anders* suggests that bloodletting is a good therapeutic measure in sthenic cases of pneumonia. The

temperature declines, the pain, the dyspnea, and the nervous symptoms improve, and the pulse is softened. In the later stages of the affection, bloodletting may be employed if cyanosis and the signs of collateral pulmonary edema supervene, but at this period, he avers, abstraction of blood is hardly ever followed by beneficial results, except in the vigorous. *Friedrich Müller* declares that when there are symptoms of beginning pulmonary edema, or when there exists pronounced cyanosis, a copious bleeding may occasion a distinct amelioration of the symptoms.

*Osler* maintains that bleeding in pneumonia is nowadays much more frequently employed than some years ago, but more often late in the disease than early. He continues: "To bleed at the very onset in robust, healthy individuals in whom the disease sets in with great intensity and high fever is, I believe, a good practice. I have seen instances in which it was very beneficial in relieving the pain and the dyspnea, reducing the temperature, and allaying the cerebral symptoms." Speaking of congestion of the lungs, *Osler* again advocates free bleeding if the pulmonary engorgement be intense. He takes from 600 to 1000 c.c. (20 to 30 ounces) of blood from the arm, and advises aspiration of the right auricle if the blood does not flow freely, and the condition of the patient be desperate.

*Tyson* is more explicit in his discourse concerning bloodletting in pneumonia. He opines that there are two periods in the course of a pneumonia when abstraction of blood may prove beneficial, viz. (1) in the first stage and early part of the second stage, and (2) where there is engorgement of the right heart. The indications in the first period include great dyspnea; full, bounding pulse, and sharp, pleuritic



pain. He states that the relief of all these symptoms by bleeding is often magical, and that the quantity of blood removed at such time should not be less than 500 c.c. (16 ounces), but the signal for discontinuing the bleeding should be sought in the abatement of the symptoms rather than in the quantity of the blood removed. The indications for bloodletting when there is engorgement of the right heart are rapid breathing with cyanosis and laboring pulse. As this stage, the withdrawal of 300 to 500 c.c. (10 to 16 ounces) of blood is often of decided benefit, and this clinician believes that he has seen life saved by such a bloodletting. He further maintains that similar results may be obtained by wet cups if a sufficient amount of blood be withdrawn thereby. Bloodletting is of especial service in pneumonia associated with pleurisy. Its effect is reinforced by a saline infusion and oxygen inhalation. Oxygen, however, should not be administered by itself in the more advanced stages of the disease, as it may add still more to the task of the right heart, already overburdened. A saline infusion may tend to accelerate the absorption of the exudate in the lungs.

One of the greatest clinicians of modern times, *v. Neusser*, is an advocate of bleeding in pneumonia when the individual is strong, and when there is great oppression with cyanosis and copious bloody expectoration.

According to *Daland* certain cases of death following venesection in pneumonia can be traced to the formation of a thrombus within the right heart while dilatation was at its maximum. In other instances the heart muscle was already affected or the toxemia had given rise to its structural change. The danger of cardiac thrombosis is due not alone to the engorgement of the venous system with blood and the subsequent

sluggishness of the circulation, but also to the remarkable augmentation of the clotting property of the blood in pneumonia. For these reasons, bloodletting should be performed as soon as the first symptoms and signs of dilatation of the right ventricle have supervened in order not only to give relief to the much embarrassed heart, but also to avert cardiac thrombosis.

*Wormely* has given some study to the effects of bloodletting in hopeless cases of pneumonia. He says that, though certain pneumonia patients have died after bleeding, in not a single instance has bleeding failed to cause some amelioration of the symptoms, and that this procedure seemed to postpone a necessary fatal termination. He also confirms the fact, already alluded to in these pages, that cardiac stimulants—like other drugs—which before the withdrawal of blood were unable to produce therapeutic effects, exhibit an increased efficiency when administered after phlebotomy. The immediate effect of bloodletting in pneumonia does not so much depend upon the quantity of blood abstracted as upon the rapidity with which it is withdrawn. The greater the rapidity of the bloodletting, the more favorable the reaction.

In closing this chapter I must not omit to record a contention of *Ewart* anent bloodletting in pneumonia. He suggests that in cases of pneumonia in which there exists considerable pulmonary exudation, the blood, owing to the drain on its plasma, may be rendered physically deficient, which would naturally have a bad effect on the heart. Bloodletting under these circumstances would still further tend to inspissate the blood, and in consequence thereof aggravate the heart's condition. It is, of course, evident that the greater the concentration of the blood, the greater must be the task which it imposes upon the heart. It

is also obvious that the presence of an extensive pulmonary exudate impedes the lesser circulation. However, one should recall that a thickening of the blood is in most instances rapidly followed by its dilution. This hydremia is the result, as has already been pointed out, of the absorption of tissue fluid. The content of fibrin decreases as the hyperemia increases. Moreover, it is advisable to combine an infusion of a sodium chlorid solution with venesection or venepuncture in such a manner that both operations are synchronously performed, viz., while the blood is being withdrawn from a vein in the one arm, the infusion is being made into the vein of the other. This synchronous operation will forestall any danger that may possibly arise from the momentary inspissation of the blood.

A brief summary of the various opinions quoted in the foregoing will clearly depict the indications and contraindications of bloodletting in pneumonia.

1. Bloodletting is indicated in all those cases in which the patient has retained his strength and in which threatening symptoms are present. It is especially indicated in full-blooded persons with strong, sound hearts, as soon as dyspnea and cyanosis point to an increasing pulmonary congestion and thus to the imminent paralysis of the right heart.

2. Bloodletting is, as a rule, contraindicated in persons that are old or greatly exhausted. In other cases, in which a marked edema or a pronounced cardiac debility has already supervened, bloodletting acts as a palliative, but does not save life. In very feeble persons bloodletting may be replaced by phlebotasis, which may temporarily relieve the obstruction in the pulmonary circulation.

The opinions enumerated in the foregoing are rela-

tively few; however, were I to quote a hundred more authors, the claim that bloodletting favorably influences a certain proportion of the cases of pneumonia, could not be better substantiated. Now as ever people will die of pneumonia, which is still the most deadly of all acute non-epidemic diseases in the adult. To be sure, bloodletting is no panacea. But it alleviates the pain in hopeless cases and gives more ease in the last hours of life than any other therapeutic factor.

### B. Pleurisy

In most of the cases in which bloodletting is indicated, it exerts a composite effect. It diminishes the volume of the blood, encourages the absorption of exudates, acts as an anodyne and as a sudorific, induces blood-regeneration, and eliminates toxic substances from the organism. As regards pleurisy, the effect of bloodletting must also be considered to be a composite one. The most salient features of pleurisy are the exudation in the pleural sac, the intense, often unbearable pain, and the dyspnea. *v. Jaksch* extols the soothing action of cupping in pleurisy, declaring that this remedial agent is as effective in rapidity and certainty of operation as the hypodermatic injection of morphin. *Thiele* claims that in desperate instances of chronic pleuritis an abstraction of blood with the subsequent, vigorously maintained perspiration, may yield miraculous results.

Dry as well as wet cups are the favorite remedies which the immigrant Slavic peoples apply in pleuritis sicca. At any rate, this is the practice among the seven or eight hundred thousand people, most of them Hebrews from Eastern Europe, which hold sway over the great East Side of New York. Patients of this stamp frequently show the marks of cupping when as

a last resort the doctor is called in. The barber, the "leech" of yore, is first pressed into service, and only when matters do not turn out as they should, recourse is taken to the regular disciple of Æsculapius. Verily, many civilizing acquisitions of the past fifty years have not as yet found their way into "Half Asia" domiciled in the American Metropolis.

*Tyson* champions local bloodletting in pleurisy. In very severe cases he thinks it affords a prompter relief than any other measure. "There is no condition," he says, "in which so delightful an effect comes to the suffering patient gasping for breath and racked with pain." He is further of the opinion that the course of many pleurisies would be cut short if blood were locally abstracted. The physician of a younger generation has hardly ever seen a live leech nor has he a set of cupping glasses in his possession. He has learned to subdue the pleuritic pain by the hypodermatic administration of morphin, and he is ignorant of the fact that bloodletting not only makes the patient comfortable without depressing him, but also promotes the absorption of exudates by the admission of superfluous tissue fluids into the blood channels. That such an absorption may occur in pleurisy has been demonstrated in numerous cases. For a number of years *Catola* has maintained that bloodletting performed during the stage of hepatization of the lungs facilitated the absorption of the collateral edema and the fatty degeneration of the pulmonary exudate. If this ensues in pneumonia why should it not be also the case in pleurisy? Local bloodletting by means of cups or leeches has, of course, its limitations as far as promotion of the absorption of the exudate is concerned. This is only accomplished by the withdrawal of larger amounts of blood, of from 5 to 8 c.c.



for each kilogram of body-weight (from about  $\frac{1}{2}$  to 1 drachm for each pound of body-weight).

A case from my own practice deserves mention in this place. The patient, a girl, twenty-two years of age, had been suffering with exudative pleuritis for a period of three weeks. When she arrived at the hospital, the impairment of the pulmonary function was such that her condition bordered on orthopnea. There was cyanosis, but no fever. The lungs were apparently compressed for many days by the voluminous exudate, but a comparatively small amount of the fluid could be withdrawn at once. Aspiration of 500 c.c. of the serous exudate brought, however, no relief at all. As quick action became imperative, I decided to perform venepuncture. Abstraction of 250 c.c. (8 ounces) of blood was immediately followed by the improvement of all the symptoms. After a few days the exudate had receded to such a degree that further aspirations were no longer called for.

In cases of purulent pleurisy (empyema), blood-letting may be employed on account of its pain-relieving effects. In extensive suppurations, blood-letting is, as a rule, contraindicated. Yet, as the pleuritic pus is contained in a closed cavity, the danger of a metastasis is out of question. Phlebotomy is, of course, precluded, when the patient is in a cachetic state.

### C. Emphysema

The literature concerning the therapeutic effects of bloodletting in emphysema and its accompanying dyspnea is quite meager. *v. Jaksch* is an advocate of wet cupping before the patient is in too miserable a condition. He says: Extremely cyanotic and with labored breath these poor patients sit up in bed or

recline in an armchair with an expression of profound anxiety in their faces. From time to time the breathing becomes still more forced, and the cyanosis and dyspnea increase. Now the right moment has arrived when from six to eight wet cups should be applied upon both sides. The relief of the distressing symptoms obtained by wet cupping endures for hours, and often for days. The effects of this procedure, as averred by the Prague clinician, are more pronounced than those of the inefficient medicinal agents at our disposal.

*Osler* states that patients with emphysema, especially when they are young and vigorous, should be freely bled when they enter the hospital in a state of urgent dyspnea and lividity, with great engorgement of the veins. More than once he has saved the lives of individuals thus affected by a timely bloodletting.

For almost three years I have made use of phlebostasis in emphysematous patients. The cases best suited for the "artificial diminution of the circulation" are those in which the venous engorgement stands in the very foreground. It is in these cases particularly that hypertrophy of the right ventricle has ensued, though this organic change may not always be demonstrable during the life of the patient. The phlebostasis relieves not only the overburdened heart, but tends to ameliorate the pulmonary as well as the gastrointestinal venous congestion. It also assists in the amelioration of the exacerbations of an accompanying chronic bronchitis, viz., the cough, expectoration and oppression. One five-minute application of phlebostasis often suffices to render the patient comparatively comfortable for a number of days; in other cases the procedure may have to be applied much more frequently. In one of my cases phlebostasis had to be

employed every three or four hours for about as many days. Any person of ordinary intelligence, when properly instructed, is able to apply this remedial measure. There is no danger of whatever nature connected with the procedure, provided the few contraindications for its employment, heretofore mentioned, have been ruled out.

#### D. Bronchitis

*Mackenzie*, whom we have become acquainted with as an advocate of bloodletting in pneumonia, also lauds the beneficial effects it exerts in bronchitis when a weak pulse and marked palpitation of the heart point to obstructions in the pulmonary circulation. Bloodletting, he maintains, promotes the absorption of the bronchial secretion, paves the way for a freer venous flow in the lungs, and tends in this manner to support the heart's activity. Its *modus operandi* in bronchitis is therefore similar to that in pneumonia.

*Schubert* relates the case of a man, twenty years of age, who, following an attack of influenza, suffered for almost twenty weeks from a constant irritation to cough. Bloodletting was followed by a complete cure within one week. He also states that in chronic bronchitides and laryngitides, manifestly due to hyperemia of the mucosa, bloodletting will furnish unexpected results.

*Osler*, who after all is more of a therapist than his students were wont to make us believe, claims that in chronic bronchitis where there is urgent dyspnea and cyanosis, a bloodletting gives most relief.

In a number of cases of bronchitis accompanied by dry catarrh or bronchorrhea, treatment by phlebotomy gave me excellent results. The following case deserves special mention. The patient, a man 52 years old, was affected with chronic bronchitis and a

dry (bronchial) cartarrh for over twenty years. He suffered frequently with severe, paroxysmal attacks of coughing, which would not yield any longer to the various palliative remedial agents. It was a great surprise to me that the very first application of phlebostasis effected the loosening of firm clots of mucus from the dry bronchial mucosa. Since then the secretion of the mucous membranes is fairly normal. Phlebostasis was thereafter employed twice weekly, for five minutes each time, during a period of about two months. The patient coughs but rarely nowadays, the cough seizures have entirely abated, he feels better than for years, and has markedly gained in body-weight.

Another case, in which the symptoms of a chronic laryngitis predominated, may also be cited in this place. The patient, a lawyer 36 years old, has long been a sufferer of catarrhal inflammation of the laryngo-bronchial mucosa. There was a chronic thickening of the laryngeal structures. The patient's voice did not "carry" at all, and at times the hoarseness was so pronounced that it could not be heard in the court-room. His cough was not very troublesome. The local treatment given by various specialists had at no time availed very much. Phlebostatic treatment, experimentally applied by me, invariably caused a rather striking reduction of the laryngeal hypermia, which, if the voice was but little used, often lasted for twenty-four hours and longer. There was no hoarseness at all for a few hours after the employment of the phlebostate.

#### E. Pulmonary Phthisis

Bloodletting as an hemostatic in hemorrhagic pulmonary phthisis for obvious reasons appears to be

contraindicated. *Huggard* relates two cases in which the tendency to pulmonary hemorrhage was successfully combatted by the abstraction of blood. Both patients were in the early stages of pulmonary tuberculosis, both were full-blooded and had no night sweats; in both the pulse was marked by high tension, the body temperature but slightly elevated, and the general condition satisfactory. The history of both patients showed repeated pulmonary hemorrhages before, but none after the prophylactic bloodletting. In one of the cases 1440 c.c. (48 ounces) of blood was withdrawn, which was followed by a decline of the pulse rate from 98 to 68 per minute.

*Huggard* attributes the chief value of bloodletting in hemoptysis to the circumstance that the artificial withdrawal of blood inflicts less injury upon the organism than its pathological extravasation into the lungs. At any rate, the blood is lost to the system, the same writer opines, but if it escapes through some weak spot of a pulmonary vessel causing obstruction and subsequent inflammation of the respiratory passages, it favors the progress of the tuberculous process. The danger of hemorrhage is particularly accentuated when the lungs are permanently surcharged with blood, as in mitral disease and dilatation of the left ventricle. When such instances of cardiac defects are complicated by pulmonary phthisis, phlebotomy, under the conditions aforementioned, serves a good purpose. However, high fever, night sweats, and general physical debility, as a general rule, contraindicate the prophylactic withdrawal of blood.

The direct cause of hemoptysis may be attributable to (1) hyperemia of the bronchial mucosa or lung tissue, (2) erosion of a blood vessel, and (3) alterations in the composition of the blood. Cases in which



the hemorrhage is caused by the perforation of a vascular wall terminate fatally, as a rule. Bloodletting here is manifestly contraindicated. However, when the anatomical substrate of the hemoptysis is a congestive state of the bronchial mucosa, when, in other words, the hemorrhage is mild, though it may be continuous and the sputa may be blood-tinged for a protracted period, the artificial abstraction of blood may not only tend to the cessation of the pathological bleeding, but also may prove of decided benefit in relieving the engorged pulmonary circulation, thereby improving the patient's general condition of health. Of such cases I had a number which I treated successfully by wet cupping, by phlebotomy, or by venepuncture. Most of these cases which, however, exhibited no primary broncho-pulmonary affection, stood an abstraction of from 250 to 500 c.c. (8 to 16 ounces) of blood very well. Of course, venepuncture is my favorite method of blood withdrawal, but wet cups, six or eight on each side, applied perhaps twice or three times in intervals of from four to six days, will accomplish similar results. The effect of phlebotomy, "the bleeding of the patient into his own vessels," strange to relate, upon this type of hemoptysis is also quite pronounced. I shall again refer to this matter when dealing with bloodletting in circulatory disturbances. Moreover, compression of the femoral and brachial veins, which in effect is phlebotomy, is a well-tried measure for the suppression of mild pulmonary hemorrhage. Compression may be produced by a piece of rubber hose, a bandage or a strap. The compression should be sufficient to suppress the venous, but not the arterial flow in the extremities. As compression of a limb is liable to cause considerable pain within fifteen or twenty minutes, *Thompson* suggests that it is best

to compress the four extremities in rotation, that is, one leg and one arm at a time. He states that he has been able to control obstinate bronchial hemorrhage in this manner when other means failed.

Whether or not any of these methods of bloodletting call forth any change in the composition of the blood in the presence of hemoptysis, has not as yet been determined. The probability is that no such change ensues. The eventual production of clots in the oozing vascular area and the consequent arrest of the hemorrhage, must not be ascribed to an alteration of the blood composition, but is simply the result of the reduction of the intra-pulmonary congestion.

*Foxwell* advocates general bloodletting when venous congestion is present, and is a believer in restricting the blood as much as possible to the systemic circulation. Among other measures he also makes use of ligatures applied to the extremities to accomplish this purpose.

General bloodletting, according to *Anders* and others, also deserves a trial in instances of erosion of a blood vessel or rupture of an aneurism. The formation of a thrombus that will stop the flow is encouraged by absolute rest and the tranquilizing of vascular agitation. A bleeding sufficiently long to bring on fainting may secure perfect quietude of the implicated blood vessels.

## II. CIRCULATORY DISTURBANCES

One of the main objects of treatment in many of the disturbances of the circulation is the reduction of the abnormally high blood pressure. We possess no other therapeutic measure which attains this end in so simple and unfailing a manner as bloodletting. One should, therefore, not hesitate, as *Burwinkel* rightly maintains, to resort to this little operation even in individuals of anemic tendency if a much increased blood pressure demands a reduction of the blood volume. The following points will lead to a clearer understanding of the facts.

By lessening the blood volume itself, peripheral resistance in general is reduced, and conditions more favorable to an unobstructed blood stream are created. The relief of the vascular system and the diminution of the blood pressure afforded correspond to the amount of blood withdrawn. Bloodletting moreover diminishes the viscosity of the blood. In its effort to maintain constancy in its volume, the blood takes up water from the tissues. By this process, the blood becomes more hydremic, less dense, and its solids are reduced in amount. The fact whether or not the blood is attenuated and therefore flows quite easily, or whether or not it is inspissated and hence flows sluggishly, is of great import as regards the rapidity of the circulation and the cardiac force that is requisite to move the blood column. The taking up of the tissue fluids by the blood causes a more ready flow of the latter from the arteries into the veins, thus removing any capillary engorgement that may exist, especially when this is located in the secreting organs. In this manner, bloodletting acts

at one and the same time as a promotor of absorption and diuresis. The veins are comparatively little exposed to pressure from transudates. This fact may explain the reason why after an abundant loss of blood a quite sudden absorption of edematous fluid and an increase in the urinary secretion ensue frequently.

Bloodletting is also said to increase the alkalescence of the blood. According to *Burwinkel* this is caused by the salts, particularly the sodium carbonate, which are contained in the tissue fluids that find their way into the circulating blood. The augmented blood alkalescence presumably is followed by an increase in the oxidizing qualities of the blood. This point, however, is still under discussion.

While I have inquired into the degree of alkalescence of the blood that was withdrawn for therapeutic purposes in a large number of instances, I have made but few alkalescence determinations at the time of withdrawal of the blood and at a uniform period thereafter. I find among my notes only five instances of bloodletting in each of which two alkalescence determinations, eight hours apart, were made. It is, however, an advantage in the proper valuation of these determinations that the amount of blood withdrawn was approximately the same in each of these cases.

DISEASE.	Amount of Blood With- drawn in c.c.	Alkalescence at Time of Withdrawal in Miligrams NaOH per 100 c.c. Blood.	Alkalescence 8 Hours After Withdrawal in Miligrams NaOH per 100 c.c. Blood.
Uremia .....	650	639.6	639.6
Uremia .....	550	533.0	479.7
Uremia .....	550	692.9	586.3
Cerebral Hemorrhage ..	700	426.4	479.7
Pneumonia .....	500	373.1	426.4

These figures, obtained by the Engel modification of the Löwy-Zuntz method, show an increase of the blood alkalescence that prevailed eight hours after withdrawal, in but two of the cases. This increase was insignificant in both instances. In the three cases of uremia the alkalescence was diminished in two, while it kept stationary in the remaining one. Thus, it is seen that my own observations do not tally in this respect with those of others, and it is certainly a mooted question whether or not an eventual increase of the oxidizing qualities of the blood after venesection is to be ascribed to what I consider a problematical augmentation of the blood alkalies.

On the other hand, it is an incontrovertible fact that, even after the withdrawal of small amounts of blood, the lymph stream is increased from ten to thirty per cent., and that when bloodletting has been performed repeatedly, the lymph may attain twice its former amount and velocity. Furthermore, the abstraction of a sufficient quantity of blood causes a dilatation of the capillary vessels, and there is little doubt that to this effect must be assigned the feeling of warmth and the tendency to perspiration after bloodletting. In this connection I wish once more to emphasize the fact that bloodletting is by far the most reliable means for the regeneration of the blood as it stimulates the hematopoietic organs to renewed and more energetic activity. Newly-formed erythrocytes have been found in large numbers in the veins proceeding from the bone marrow, and likewise in the spleen, within an hour after the operation. It stands to reason that on account of the augmentation of the red blood cells, which are the carriers of oxygen, the nutrition of the tissues is improved, a circumstance which, in a measure, is also of benefit to the heart muscle and the blood vessels.



Finally, the removal from the blood of toxic products effected by bloodletting, especially of the excess of carbon dioxide, is of importance as well to the organs of respiration as to those of the circulation. Although there can be but little doubt that the cathartic action, i.e., the "blood-cleansing" propensities of bloodletting, has been grossly exaggerated in times gone by, it is an experimentally and clinically demonstrated certainty that an excess of  $\text{CO}_2$  acts as a toxic irritant to the respiratory and vascular centers, and that the removal of a portion of this irritant by means of the abstraction of blood is in many cases followed by a more or less marked alleviation of the symptoms caused by the toxic influence of the  $\text{CO}_2$  upon these centers. As may be seen, the relations of bloodletting to the disturbances of circulation are manifold. In the following will be found a brief discourse on the influence of bloodletting upon plethora, heart and vascular affections in general, and pulmonary edema.

### A. Plethora

Plethora in the sense of an increase in the total blood volume is of rare occurrence. Plethora manifests itself principally by a hyperemic condition limited to certain vascular regions, while in other organs or parts of the body the blood volume is rather diminished than increased. Still, no matter what type the plethora may assume, the menace to the health arising from it frequently demands the reduction of the blood pressure, for which purpose no more efficient means than bloodletting has yet been devised. This, at any rate, is the general consensus of opinion of all of those who have given much study and thought to this question. *Hahn* has by exact measurements demonstrated a steady decline of the previously abnormally high blood pressure.

After the withdrawal of 200 c.c. blood, the pressure receded from 170 to 190 mm. Hg. to 140 mm. Hg., and remained at this lower level for an entire week. From that time on, the pressure slowly rose again, but never attained its former height.

The symptomatic treatment of plethora—the reduction of the blood pressure—is also accomplished in about half of the cases that are subjected to phlebotasis. Of course, the decline may not exceed five millimeters of mercury, and the period during which the pressure is reduced may not last longer than a few hours. When phlebostatic constriction in the four extremities is made use of, the blood pressure may decrease for from 10 to 20 mm. Hg., and a decline of 5 to 10, or even 15 mm. Hg., may persist for twenty-four hours, or longer.

The duration of the decline of the blood pressure, as I have already pointed out, depends only in part upon the amount of blood withdrawn; it is principally governed by the elasticity of the blood vessels. Under normal conditions, an automatic-regulatory narrowing of the blood vessels ensues, that is, the circulatory system has the tendency to adjust itself to the diminished volume of the blood. In atherosclerosis, on the other hand, the blood pressure remains permanently lowered, as the more or less intense rigidity of the vascular walls permits their limited contraction only. This circumstance may be of import in the prevention of cerebral hemorrhage, about which some pertaining data will be found elsewhere in this treatise. But even though the reduction of blood pressure by the abstraction of blood is but a more or less circumscribed and temporary one, the short period of rest, together with the diminution of the high tension in the entire vascular system, the cessation of congestions, vertigo, intra-

cranial pressure, hyperemia of the external and internal integuments, etc., signify that the bloodletting has afforded a great deal of relief.

### B. Heart

We have learned that it is principally the disturbances of the lesser circulation, and the resulting, often imminent heart failure, caused by pneumonia, which yields so promptly to bloodletting that this little operation may, with a great deal of justification, be considered a life-saving procedure under certain well-defined circumstances. However, in the absence of pneumonia or other affections of the respiratory organs, bloodletting has also proved an exceptionally effective therapeutic factor not alone in primary cardiac affections, but also in those which are secondary to blood vessel or renal disease. The heart and the entire vascular system together with the kidneys are practically one in a clinical sense. Remedies influencing the peripheral circulation and the renal activity also affect the heart in a greater or lesser degree.

When in affections of the myocardium or on account of decompensated valvular lesions heart failure seems impending, and the increasing cardiac weakness is productive of grave disturbances in the pulmonic circulation, the withdrawal of an abundant amount of blood will immediately relieve the embarrassed left auricle, and the intrathoracic balance and circulatory momentum are soon reestablished. A definite symptom of the relief afforded by bloodletting is the deeper and prolonged respiratory excursions which automatically follow the mitigation of the engorgement. In this manner the reserve forces of the organism find time and opportunity to recuperate, when otherwise the heart would be stopped in its function before the re-

serve forces would have been sufficiently activated. This may be observed, for instance, when administering diaphoretic or diuretic remedies. These therapeutic agents serve a good purpose when they are employed at the proper time, i.e. before cardiac debility has reached such a degree that they can no longer exercise their full activity before the patient succumbs. Bloodletting, on the other hand, acts instantaneously, no matter whether the heart is primarily diseased or secondarily involved by an existing atheromatosis, nephritis, pulmonary edema, etc.

*Hufeland*, the author of the famous *Makrobiotik*, or the art of prolonging life (1796), which was translated into most European languages, called bloodletting the most powerful, but also the most drastic of all the remedies, and was an ardent advocate of copious and frequent blood withdrawals in heart disease. The mechanical value per se of the relief afforded to the overstrained heart is apparent. The velocity of the blood current is decreased in proportion to the amount of blood withdrawn. The blood pressure declines at the same ratio. The smaller the volume of blood contained in the vascular system, the lighter will be the heart's work in presiding over the circulation. Naturally this only holds good to a certain degree, for the heart suspends its activity if there be nothing or not enough to pump. In order to maintain cardiac activity, "dry" pumping must be prevented under all circumstances. This prevention of "dry" pumping is the chief indication for the administration of saline infusions.

A single bloodletting of about 250 c.c. renders valuable service in myocardial disease due to atheromatosis. Congestive cardiac states following compensatory disturbances require, on the other hand, repeated

withdrawals of blood. It is only by repeated blood-lettings that the general as well as the pulmonic circulations can be relieved, and that more favorable circulatory conditions be secured and maintained. By this means failure of the heart muscle and also a capillary stasis, possibly tending to edema or connective tissue changes in the various organs, is forestalled. In pronounced cases of decompensation the most distressing and alarming symptoms, particularly cardiac asthma, are almost instantly removed by a timely bloodletting. A lasting compensation is not infrequently obtained after the blood has been abstracted by the exhibition of cardiac stimulants (*digitalis*, etc.), which, previous to the phlebotomy, had been employed with little or no effect. In this connection I wish again to emphasize the clinical fact that medicinal or other therapeutic agents generally exert a more prompt and lasting influence after than before the bloodletting.

It is by no means necessary to look for a full and irregular pulse, if bloodletting is contemplated. Even the physicians of yore considered bloodletting all the more indicated when the pulse was small and intermittent, and the extremities cold, when, in other words, anemia was present.

In urgent cases of dyspnea and convulsive attacks arising on the basis of a congenital affection of the heart, bloodletting may often afford immediate relief. In instances of this kind, the application of about four leeches over the precordium may be all that is necessary. The phlebotome may also be employed to advantage. As individuals with congenital cardiac disease do not bear well the abstraction of blood, amounts not exceeding 75 c.c. (2½ ounces) should be removed at any one time.

While bloodletting is, as a rule, hardly called for in



acute pericarditis, some leeches applied over the precordium at the onset of the affection, which is so difficult to determine, may relieve the most cogent symptoms. However, when in a robust subject the circulatory embarrassment and engorgement of the right heart are marked, the abstraction of a few ounces of blood from the arm will, according to *Colbeck*, sometimes give great relief.

The same author, speaking on the reduction of work performed by the heart in conjunction with the relief of venous congestion and of the morbid conditions associated with it, maintains that the first question the medical attendant must ask himself in a given case of cardiac and venous engorgement ought to be, whether or not bloodletting is indicated in order to disperse this engorgement. He is of the opinion that if the right heart is distended to a degree that failure of the ventricle is imminent, blood should be withdrawn either by venesection or by leeches without hesitation. Venesection should, however, not be resorted to, he declares, unless there be proof that the ventricular muscle is sufficiently competent to respond to this method of sudden relief. He asserts that the removal of from 250 to 300 c.c. (8 to 10 ounces) of blood is, as a rule, sufficient in cases of this type. In my opinion, this is a minimum dose, as it is frequently necessary to withdraw twice that amount in order to insure definite results. The employment of leeches in failing compensation is hardly ever crowned with success.

*Lauder Brunton* avows that general bloodletting is a remedial agent that is too little used nowadays. In engorged states of the right heart, caused either by mitral incompetence or pulmonary affections, bloodletting, he declares, not only relieves the symptoms, but

may save the patient's life. *Brunton* is also an advocate of local bleeding by means of leeches and cupping. He states that it is not simply the removal of blood which gives rise to beneficial effects, as similar good results may be obtained by dry cupping, where no blood is withdrawn from the local circulation. He opines that the beneficial influence of dry cupping may in part be caused by "a reflex effect of the stimulus upon the circulation, both local and general, and it may possibly be, to some extent, a form of serum therapeutics, as the fluid which exudes into the tissues after the application of the cups may undergo some alteration which imparts to it a curative action after its reabsorption."

The primus of modern cardiologists, *James Mackenzie*, holds bloodletting in high esteem in the treatment of the diseases of the heart, deploring, however, the temporary character of the relief which it affords. Notwithstanding the fact that he has turned to account bloodletting in a great variety of cases, he cannot state that he has seen it do any lasting good. In extreme cases, he maintains, it merely delays the end. *Mackenzie* employs bloodletting when there is distress in breathing, on account of great distension of the right heart, which may generally be recognized by an increase of cardiac dulness toward the right. When such enlargement of the right heart is not determinable, which may be the case in instances of high blood pressure (cardiosclerosis), the tense filling of the veins of the arm are this author's indication to practice bloodletting. He has always bled at the bend of the elbow and removed from 600 to 900 c.c. (20 to 30 ounces) of blood. He concludes that the instantaneous alleviation of the distressing phenomena is frequently very striking, particularly in cases with auricular fibril-

lation, and cases with high blood pressure and extreme failure of the heart.

*Burwinkel* declares that in cases of high pressure stasis it would be decidedly more rational to encourage the flow of blood from the peripheral arteries by lowering the venous pressure, than by drawing on the last reserve strength of the heart in an effort to overcome the peripheral resistance with the aid of digitalis and other drugs. The same writer also states that bloodletting favorably influences angina pectoris, and that it may markedly mitigate the manifestations of engorgement called forth by emphysema, asthma, kyphoscoliosis and pleural adhesions. His experience corresponds to that of other clinicians when he states that in most cases of heart disease bloodletting gives more immediate relief than every other single remedial agent. Fearing the possibility of thrombosis, he believes that bloodletting is contraindicated in instances of chronic heart lesions. The danger of thrombus formation after bloodletting is undoubtedly exaggerated. For my part, I have never seen one instance of thrombosis appearing in the wake of venepuncture and phlebostasis, the two methods which I employ to the practical exclusion of all the others. Of course there are many and probably more efficient remedies than bleeding for the treatment of chronic valvular disease. Still, when complications arise that urgently require bloodletting, the attendant should not hesitate to perform the operation. It may possibly be necessary to guard against a too sudden relief of the embarrassing symptoms. This is accomplished by employing a trocar or needle with a narrow lumen, or in case phlebostasis is made use of by permitting the air to escape but very slowly from the inflated cuffs.

Personally, I have resorted to general bloodletting

in more than a score of cases of primary heart disease. My usual guidance, excepting in a few instances, was an engorgement of the right heart with its concomitant features. However, I have employed the procedure in a number of cases in which an overfilled right heart did not serve as an indication. The following brief report of one of these cases may be of interest to a wider circle:

The patient, a woman 55 years old, was brought to the hospital after repeated attacks of angina pectoris in the latter part of 1908. On the day of her arrival she had a typical anginal attack, which could but partially be subdued by morphin and nitroglycerin. Another paroxysm occurred on the following day; the agonizing pain and the sense of impending death were of such a character that the patient begged for euthanasia, declaring that she could not stand another one of these attacks. After the attack, which lasted almost three minutes, I decided to resort to venepuncture. The blood pressure amounted to 170 mm. Hg. Blood to the amount of 450 c.c. was withdrawn. After the bloodletting, the blood pressure had declined to 155 mm. Hg. The patient remained under observation in the hospital for another week, but no additional paroxysms occurred. As far as I know, she never has had any attacks up to about two years ago, when I last had heard from her.

Mitral stenosis is one of the forms of chronic cardiac lesions in which bloodletting may accomplish a great deal of good, although there exists, as a rule, no engorgement of the right heart before decompensation has considerably progressed. The cases of this affection which I find most benefited by an abstraction of blood are those in which there is an early tendency to epistaxis and hemoptysis. Such hemorrhages are in

my opinion compensatory efforts on the part of the organism to reduce the volume of the circulating blood, and it is a fact that the shortness of breath, the cough, the frequent palpitation and the chest-constriction generally abate for some time after a more or less profuse hemorrhage from the congestal veins of the nose or from those of the pulmonic area. Cases giving a history of such early hemorrhages or of long-continued cough with expectoration of blood-tinged mucus, are particularly amenable to timely bloodlettings during the period of failing compensation. The blood should be withdrawn when the dyspnea overshadows all the other manifestations of the disease, but more especially when there is a tendency to paroxysmal seizures of air hunger, resembling renal asthma. These are cases in which not alone goodly amounts of  $\text{CO}_2$  are retained in the blood, but in which kidney function is below normal though no primary renal lesion can be demonstrated, as a rule. In spite of the fact that a patient with mitral obstruction may present a well-marked anemia, the amount of blood withdrawn should never be less than from 5 to 8 c.c. for each kilogram (from a little more than half a drachm to slightly less than a drachm for each pound) of body weight.

There is no doubt that phlebotasis will serve a good purpose in most of the cases of heart disease in which bloodletting is indicated. True enough, the blood kept from circulating for a certain length of time by constricting the extremities, does not diminish the heart's overwork for a protracted period, as a rule. Still, I have had some marvelous results, even in this respect, as will be evinced by the following case history, reported in the Archives of Diagnosis, October, 1914, in an article entitled "Ptyalism—a Danger Signal in Renivascular Disease."



Male patient, 58 years old; consulted me first on December 24, 1912. He complained chiefly of "asthmatic attacks," coming on after exertion. There were no nightly seizures. The amount of his twenty-four hours' urine hardly ever exceeded one liter. He did not, as a rule, urinate during the night, and did not complain of frequent micturition during the day. He never had any edemas nor headaches.

The physical examination showed a rather short man weighing 140 pounds. There was some emphysema. The area of cardiac dulness was markedly increased toward the left as well as toward the right. There existed no valvular disease. The heart beats occurred in regular sequence. The first pulmonic and aortic sounds were accentuated. The systolic blood pressure was 240 mm. Hg. Neurologically there were no special abnormal phenomena. There was some evidence of cerebral arteriosclerosis as, for instance, the characteristic gait. This was remarkably short, the feet were spread widely apart and were hardly lifted from the ground when walking. His hands were often thrust out, as if he feared falling down. There were, however, no special mental symptoms.

The urine exhibited a specific gravity of 1,015; contained a small amount of serum albumin, but neither glucose, indican nor any normal constituent in excess. The sediment showed crystals of sodium oxalate, very little cellular material, and no renal epithelia or casts.

Two phloridzin tests evidenced a perfect functional activity of the kidneys.

*One application of phlebotomy for three minutes relieved the attacks of cardiac dyspnea for a number of weeks.*

In February, 1913, the patient first noticed a positive increase in the salivary secretion. His blood pressure

had remained stationary, and the urinary findings were almost identical with those made on the occasion of his first examination. About six to seven weeks later the patient was affected with cerebral thrombosis, which was followed by hemiplegia and mild aphonic manifestations. He died in coma about two months later.

*v. Tabora, Tornai, Lilienstein and Engel* bear witness that cardiopaths treated by "bloodless bloodletting" note a subjective improvement of their condition. Their dyspnea is diminished or disappears altogether, the respirations become deeper and these patients once more enjoy a good sleep. During the period of actual constriction of the extremities, the dullness over the right heart may diminish from 1 to 2 cm., and even more, a fact that may be verified by examining the cardiac area by means of the Röntgen ray.

*Tornai* was the first to notice the eventual reduction in size of the right heart while the cardiopath is under the influence of phlebostasis, and considers it a favorable phenomenon. In every one of my cases of heart disease in which phlebostasis was used, I have, on starting treatment, outlined the area of cardiac dullness by percussion and the size of the heart by skiagraphy before and during the application of the compression cuffs. Roughly speaking, a diminution in size of the right heart ensues in one-half of the pertaining cases. These, in my experience, are generally such cases in which the deterioration of the myocardium, particularly that of the right ventricular muscle, has not attained that degree that all hope must be left behind. It is, in fact, just this class of cases in which the salutary effect of phlebostatic treatment is so evident.

While the patient is under the influence of phlebostasis, an eventual accentuation of the second pulmonic

sound becomes markedly diminished, and the various murmurs generally assume a different character; they are either not audible at all or lose their harshness, becoming softer in every instance, and somewhat musical and lighter in timbre in a certain proportion of the cases.

During the application of phlebostasis the apex beat often becomes less tumultuous and the cardiac palpitation may cease altogether. The cyanosis which so often exists in various types of chronic heart disease may also diminish during or after artificially induced venous stasis.

*Engel*, who has treated a number of patients affected with cardiac and renal disease by means of the phlebostate at the first medical clinic of the Berlin Charité, has taken arterial and venous tracings and cardiograms which objectively confirmed the clinical effects of the therapeutic method.

According to *Lilienstein* the electrocardiogram also shows alterations which demonstrate an undoubted favorable influence of the procedure upon the dynamics of the heart.

A few of my chronic heart cases in the treatment of which phlebostasis played a prominent part, may find brief mention at this place.

A man, 57 years old, showing fatty disease of the myocardium and beginning cardiac dilatation. He complained of shortness of breath on the slightest provocation, much drowsiness, occasional precordial discomfort, flatulence and constipation. The urine showed no evidence of either a primary or secondary kidney disease. The treatment consisted in the reduction of carbohydrates in the diet, daily walking exercise for 40 minutes, deep breathing for from 10 to 15 minutes in the morning and evening, and the applica-

tion of phlebostasis three times a week during the first month, then once a week for three months. Each phlebostatic application lasted for from 10 to 15 minutes, and the patient was ordered to breathe as deeply as possible during this time. (Deep breathing, especially during the application of phlebostasis, when the cardiopath can always breathe easier, has a tendency to favorably influence congestive states in the thoracic and abdominal cavities.) After a few applications the shortness of breath, the drowsiness, and the precordial uneasiness had entirely vanished. Phlebostatic treatment was continued for about four months, because the patient desired it. As far as subjective symptoms go, he is perfectly well at this writing.

Man, 37 years old, affected with advanced myocardial disease, including pronounced dilatation of the left and right halves of the heart. For years patient has had shortness of breath on walking and after meals. For some time attacks of dyspnea had occasionally supervened during the night. Of late has had long periods of orthopnea, and precordial distress or pain is practically present all the time. The patient further complains of insomnia, fulness of the abdomen, loss of appetite, digestive disturbances, scanty urination and slight edema of the lower extremities.

Besides a bluish-icteric coloration of the cheeks and nose, and the marked cardiac dilatation, the diagnosis of which was confirmed by a Röntgen-ray examination, the patient exhibited a low pulse pressure, was quite emaciated, had a very much enlarged liver, and showed all the earmarks of an engorged portal circulation. The legs were moderately dropsical, and there were evidences of a recent, undoubtedly deuteropathic, dry pleurisy on the left side. The density of the urine was 1017; it contained goodly amounts of albumin, no su-

gar, and no indican. Microscopically some epithelia from the kidney and the lower urinary tract, and a few leukocytes were demonstrated in the urinary sediment. Neither fat globules nor connective tissue shreds could be found therein.

The treatment consisted in absolute rest in bed, an exclusive milk regimen, graduated deep breathing exercises, and the application of phlebostasis for 10 minutes every other day. After four weeks of treatment, the cardiac dilatation had markedly decreased, the size of the liver was nearly normal again, the urine contained no longer any albumin, and the morphological evidence of renal congestion, and the dropsy of the lower extremities had disappeared, and the subjective symptoms, orthopnea, precordial pain, insomnia, etc., had entirely vanished. The patient is now up and about and attending to his affairs for six hours every day, takes medium doses of a digitalis preparation, and has phlebostasis employed by his wife twice daily, for from 20 to 30 minutes each time. This procedure has thus far averted the recurrence of orthopnea and has enabled the patient to get along tolerably well. The timely adoption of this plan of treatment has, no doubt, saved the patient's life; his heart muscle, however, is so weak and the cardiac dilatation after all so pronounced that it is but a question of time when the phlebostate will be powerless in overcoming the inertia in the circulatory system.

Man, 53 years old, was for years under treatment of a vaguely and wrongly diagnosed cardiac lesion. The patient was almost in a collapse and looked moribund. His chief complaints were: Shortness of breath when making the very slightest effort; a bothersome cough with the expectoration of blood-tinged mucus; great weakness; loss of appetite; gastrointestinal



flatulence; mental inertia; sleeplessness and frequent attacks of pleurisy or bronchitis.

The physical examination showed in general a sallow color with a dusky hue over the lips and cheeks. The pulse was arrhythmic, assuming a bigeminus character from time to time, i.e., the beats occurred in pairs, with a pause between each pair. The apex beat was displaced somewhat outwards and downwards, and there was epigastric pulsation. Although percussion showed an increase of cardiac dulness, the Röntgen-ray examination, made on a later day, demonstrated that the size of the heart was much larger than would correspond to the dulness area. Under the X-ray, the pericardium appeared quite flabby, and was immensely broadened in the apical region. At the root of the aorta a bulging about 3 cm. in diameter was plainly visible. A rough, loud murmur lasting during the entire diastolic period was heard in the immediate vicinity of the apex beat. (Three weeks later this murmur was not audible any longer.) The patient also exhibited phenomena due to congestion of the portal circulation. The liver dulness was above and to the left, convergent with that of the cardiac area. The scanty urine was rather low in density, showed some albumin, but no evidence of a primary kidney lesion. The phloridzin and phenolsulphonephthalein tests manifested a fair renal function. A diagnosis of mitral stenosis in the stage of broken compensation was entertained, and the patient treated accordingly.

Phlebostasis played a prominent rôle in the management of this case. It invariably shortened the attacks of cardiac asthma when the apparatus was applied during one of the seizures, or these were entirely averted by the timely employment of the procedure. The cough and blood-stained expectoration were dimin-

ished and often ceased altogether for from one to three days; the patient felt generally better and stronger, became ambitious and transacted business; his appetite became less capricious, and he slept through the nights, as a rule. Of course, phlebostasis was not the only remedial agent employed in this case, but the same drugs which were given at the time of the phlebostatic treatment were also administered before this was instituted. Then, however, they had availed little or nothing. "Bloodless bleeding," I dare say, has prolonged the life of this patient for about four months, for when he came under my observation he was to all intents and purposes in a moribund condition. One day he remarked to me: "I know there is no help for me, but these few days of grace are so free from oppression and depression that I am reconciled for all that I have suffered during the years gone by."

### C. Blood Vessels

#### 1. ATHEROSCLEROSIS

Atherosclerosis and aneurism are the two principal affections in which the alterations in the vascular walls are favorably influenced by bloodletting. This, in the first place, promotes the nutrition of the blood vessel walls by stimulating the circulation and improving the conditions of the blood itself. The vascular endothelium maintains a constant interchange with the blood, withholding from it during its passage the material necessary for the nutrition and repair of the vessel walls. The quality of this anabolic material is generally much improved after a withdrawal of blood. However, the main import of bloodletting in atherosclerosis depends upon its depleting, deviating and hemostatic effects. Many individuals with advanced

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atherosclerosis are always at the brink of cerebral apoplexy when there is a rush of blood to the brain which may either be brought on by physical or psychological causes. The rigid walls of the blood vessels, unable to withstand the unusual pressure, burst and empty their contents into the brain. The danger of cerebral hemorrhage is the greater, the less resilient the vascular walls and the more plethoric the individual. Persons without exhibiting a condition of general plethora may just the same be predisposed to cerebral hemorrhage; hyperemia of the brain may be sufficient cause. It stands to reason that, if bloodletting is a sovereign remedy when there is an engorgement of single organs or parts of the body, it ought to be the first and cardinal measure when atherosclerosis and hyperemia of the brain are found associated. The depleting effect of bloodletting is such that the rigid vessels are enabled to withstand the lower pressure. It is especially favorable for the individual with atherosclerosis that the diminution of blood pressure caused by the decrease of the amount of blood, for reasons already stated, endures for a comparatively long time.

The deviating effect of bloodletting is next in importance so far as the treatment of atherosclerosis is concerned. It matters not whether one understands by the term "plethora" an increase of the total amount of blood or but its unequal distribution whereby a hyperemia of the brain may exist while less than normal amounts of blood are contained in other vascular regions: the timely deviation of blood from the brain may avert a stroke of apoplexy and, perhaps, save the patient's life. However, if an apoplectic seizure has already ensued, its direct effect and its more remote consequences may be much attenuated or even entirely appeased by a copious bloodletting which diverts the

blood current in another direction. Bloodletting, it must be known, not only lowers the cerebral blood pressure, but also causes the arrest of the hemorrhage into the brain textures.

It may sound paradoxical to assert that bloodletting exerts hemostatic influence. This apparent contradiction, however, is readily explained when one goes to the root of the matter. *Thiele* makes a pertinent comment. If an underground water main, he says, springs a leak as a result of undue pressure from within or without, the water is forced out with great violence, tears up the earth and street pavement, and frequently causes great havoc in a very short time. The experienced official will either turn off the main supply, or if this is not possible, he will tap the system in some other convenient place above the leak, where he can regulate the flow at will—for the water escapes to the point where it finds the least resistance—and thus the danger from the broken main is minimized.

It is evident that when hemostasis is to be effected by the artificial withdrawal of blood, the attendant must generally proceed from the principle that the amount of blood to be removed must be smaller than the volume of blood which is to be saved for the benefit of the organism by the bloodletting. For this reason general bloodletting for hemostatic purposes is rather contraindicated in gastrointestinal, uterine and pulmonary (not due to cardiac disease) hemorrhages, since the loss of blood from the artificial opening in the vein of the arm would, in most cases, soon exceed the amount of blood that should be saved in behalf of the patient. The case reported by *Huggard*, a consumptive of pronounced plethoric appearance who was cured of hemoptysis (not the cardiac variety) by venesection, is undoubtedly an exception to the rule. In

cerebral apoplexy, on the other hand, the clinical reasons for bloodletting are quite different. Here it is not the question of saving, but of removing a goodly amount of blood. Here it is the main endeavor to materially reduce the blood pressure, and to maintain it at a comparatively low degree, if possible, for some time. Under certain conditions it is an *indicatio vitalis* to arrest the dangerous hemorrhage into the brain; this can only be accomplished by a copious and timely bloodletting.

How effectively a prompt withdrawal of blood may act by deviating the blood current and arresting the hemorrhage when cerebral apoplexy has already ensued, is illustrated by the following case of *Campbell*. This author abstracted about one liter of blood from a man 65 years old, who was struck with apoplexy. The patient fell into a deep sleep from which he awoke, fully conscious, after four hours. Recovery was complete. It is hardly necessary to add that similar good results may also be obtained in traumatic cerebral hemorrhages and their sequels, like convulsions, paralyses, etc.

In a number of cases I was able to avert immediate danger and in some I have witnessed distinct improvement by the performance of bloodletting after a stroke of cerebral apoplexy. In such cases, bloodletting can never cause injury, but may be the source of much good. Why stand by with idle hands, so long as the lamp of life is still flickering? How do the effects of the nugatory and delusive drugs compare with those of bloodletting in arresting a hemorrhage of the brain?

In pneumonia, the abstraction of blood may be a life-preserving procedure by reason of its removing the obstructions in the pulmonic circulation which overtax the heart's functional ability. In a similar man-



ner life may be saved in imminent or existing cerebral hemorrhage by this remedial agent, as it tends to prevent more extensive destruction of the brain substance. The physician should, therefore, be resolute in cases of this kind, and promptly proceed to withdraw 500 c.c. and more of blood without undue delay and prolonged consideration of the clinical symptoms, as blood pressure, pulse tension, etc. If need be, the operation should be repeated six or eight hours later. In plethoric arteriosclerotics prophylactic bleeding should not be deferred when headache, tinnitus, vertigo, irritability, rapid pulse, insomnia, flashes of light, auditory hyperesthesia, or convulsive movements have made themselves manifest. When only two or three of these phenomena are found associated, leeching or wet-cupping may be all that is called for. Symptoms like headache, tinnitus or vertigo may, and often do, yield to phlebotasis. However, when more than three of aforementioned phenomena have existed together for upwards of a week, and if the patient is arteriosclerotic and full-blooded, the withdrawal of about 500 c.c. of blood becomes imperative. Arteriosclerotics with contracted kidneys may guard for years against cerebral hemorrhage and cardiac failure by periodical bleedings.

In cases with a moderate degree of plethora and arteriosclerosis, it might occasionally be more rational to resort to fasting, underfeeding, catharsis, the reduction of blood viscosity and the application of phlebotasis rather than to immediate recourse to the abstraction of blood. Personally, I am able to record very satisfactory results from such a bloodless combination treatment.

On the other hand, periodical bleeding is earnestly recommended in many instances of pronounced athero-

sclerosis, even when the attribute "plethoric" cannot be applied to the patient. By the aid of these blood-lettings the vascular degeneration can frequently be arrested and premature old age averted.

*Osler* advocates bloodletting in cases of atherosclerosis coming under observation for the first time with dyspnea, moderate lividity, and manifestations of cardiac incompetency. He adds that in some high tension cases, "striking relief" may be attained by the withdrawal of 600 c.c. (20 ounces) of blood.

*Sansom* declares that in cases of arterial disease where the main difficulty is located in the right ventricle, where venous enlargement or pulsation is apparent, "the too much neglected bloodletting is a most valuable measure." He also dwells on the fact that the so-called cardiac tonics remain without any effect whatever "when the right ventricle is overdistended or when its every systole forces a considerable back wave into the venous system." After the abstraction of 180 or 250 c.c. (6 or 8 ounces) of blood, it is his experience, the distension may subside, and the cardiac remedies would then become potent. While one such bleeding will often afford relief it is generally requisite to repeat the operation after a few days.

No matter how potent bloodletting may be in protecting the atheromatous vascular walls by reducing the blood pressure and altering the blood composition, an undue diminution of the vascular tension must be avoided when dealing with atherosclerotic individuals. One must never lose sight of the fact that an eventual high blood pressure concomitant with a case of angiosclerosis is often but an expression of a compensatory effort on the part of the organism to propel the blood through the arterioles, that, in other words, a blood pressure higher than normal may be absolutely essen-

tial in these cases, and that its material reduction may be fraught with manifold dangers. In the low pressure cases of atherosclerosis, cerebral hemorrhage, it is true, occurs only rarely, but other circumstances which are not less a menace to life are apt to supervene at short notice. Be this as it may, plethoric persons without atherosclerosis can stand a greater loss of blood than full-blooded individuals with blood vessel degeneration. If in both these types the same amount of blood were withdrawn, it would be found that, for reasons already dwelled upon, the blood pressure in the arteriosclerotic had declined more than in the mere plethoric. It is of advantage to the arteriosclerotic patient that when his blood pressure is once reduced by depletion, it has the tendency to remain so for a more or less protracted period. However, when the blood pressure is too much diminished, the risk may be incurred that the heart "pumps empty." If the vascular lumen does not contract in spite of the reduced volume of blood, that stage of anemia will quickly supervene which makes a cessation of bloodletting imperative. If the tissues of the subject of atherosclerosis contain an abundance of water, the circulating fluid will remain fairly constant by reason of the hydremia which ensues immediately. In case, however, the water content of the tissues be deficient, it is advisable to give a sodium chlorid infusion without delay in order to prevent an excessive and dangerous reduction of the fluid circulating in the vascular system.

In the treatment of hypertension *Riesman* has, as he expresses it, "abiding faith" in venesection. Bloodletting, he points out, never was entirely discarded at the Philadelphia General Hospital, and in the past twenty years it has once more gained in popularity and is forging its way into general practice. He main-

tains that it is safe to withdraw in such cases up to 500 c.c. (one pint) of blood, and when the pressure instrument is kept on the arm and the pressure controlled, 600 or even 750 c.c. (20 to 25 ounces) may be removed. "The relief from symptoms," he concludes, "is often magical."

Speaking on the management of cases whose arterial hypertension has given rise to impending myocardial incompetence, renal insufficiency or cerebral hemorrhage, *Babcock* declares that "if throbbing temples and a flushed face in a person with thick, short neck, seems to portend a cerebral hemorrhage, or if dyspnea is troublesome," bloodletting should be resorted to. While the abstraction of 500 c.c. (one pint) of blood is in his experience usually sufficient to obtain the desired result, he knows of cases where twice that amount of blood was removed with prompt relief to the patients. With earlier writers he believes that Nature has shown the way for bloodletting by inducing epistaxis or a hemorrhoidal flux. In his opinion, the blood pressure is much, but as a rule not permanently lowered by depletion. This, he maintains, is a rational measure to overcome a critical phase of the patient's disease.

In all the cases at the foundation of which there may be a spasticity of the vasoconstrictor nerves, as in migraine and its concomitants, angina pectoris, and the so-called "angina abdominis" or "angina pectoris pseudogastrica," atherosclerosis may augment the effects of the vasoconstrictor influences. In such cases bloodletting is indicated, and in many it will afford prompt relief. *Brunton* recommends bloodletting in angina pectoris when the blood pressure remains high after the exhibition of the various vasodilators, etc. Phlebostasis renders good service in some of the affections that are due

to spasms of the vasoconstrictors. Allusion to this will be found under the proper headings.

In about one-half the cases of atherosclerosis not only the arteries but also the veins are involved in the degenerative process. The veins thus altered are generally dilated. Phlebosclerosis is frequently encountered in the abdominal organs, and, according to personal observations, it is this condition to which must be frequently ascribed the symptom-complex known as "abdominal arteriosclerosis." While phlebosclerosis per se will hardly ever exhibit threatening symptoms, its various manifestations demand about the same treatment as those of arteriocapillary fibrosis. In phlebosclerosis not associated with arterial disease, bloodletting is, however, but rarely indicated. On the other hand, in overfulness of the abdominal and hemorrhoidal veins and in abdominal phlebosclerosis, brief but often repeated phlebotasis applied to the arms has rendered me very good service. It relieves the abdominal venous stasis, the fulness, pain and intestinal tenesmus and makes the patient's life generally bearable, if not comfortable.

## 2. ANEURISM

The favorable influence of bloodletting upon aneurism of the aorta has already been recognized by Hippocrates, Valsalva and Albertini. The physicians of yore frequently succeeded in reducing the vascular sac by the removal of larger amounts of blood, repeated at longer intervals, or by minor bleedings, following each other in more rapid sequence. In modern times, bloodletting in the treatment of aneurism has been lauded by *Davison*. The dilatation of the aneurismal sac is caused by the pressure of the blood. If together with the withdrawal of blood the pressure is dimin-



ished, the reduction in the size of the vascular tumor is rendered possible so long as the vessel walls still retain a sufficient number of elastic fibers. One of *Davison's* cases was an aneurism of the thoracic aorta in a man 40 years old. For a period of three years the patient had been subject to aortic insufficiency and attacks of dyspnea. During one of these attacks, which was particularly violent, this author withdrew almost a liter of blood. Breathing at once became easier, partly owing to the fact that the engorgement in the pulmonary circulation was relieved and partly because the accumulation of  $\text{CO}_2$  in the respiratory centers had been removed.

Among some of the foremost clinicians of today a consensus of opinion prevails that in dyspnea and great venous congestion, due to aneurism of the thoracic aorta, free bleedings should unhesitatingly be made.

*Osler*, for instance, says that if in thoracic aneurism dyspnea is associated with cyanosis, it is best relieved by bloodletting. He also states that free venesection will occasionally promptly alleviate venous engorgement, especially of the head and arms, and that abstraction of blood may be resorted to at any time during the course of a thoracic aneurism if attacks of dyspnea with lividity ensue. He is also aware of the pain-controlling property of the procedure in these cases.

Some years ago I saw in consultation a woman, 73 years old, who presented most of the symptoms of thoracic aneurism, as pain, dyspnea, dysphagia, cough, hoarseness and spitting of blood. As the patient had not been able to ingest any food for a number of days, was greatly enfeebled and practically in extremis, I determined to bleed her at once. By venepuncture I withdrew between 400 and 500 c.c.

(13 and 16 ounces) of blood. The pain and dyspnea were immediately relieved; the dysphagia and other symptoms, however, still prevailed, though in a somewhat milder fashion. The patient was quite comfortable for a week following the abstraction of blood. It was reported to me that she died on the tenth day of a large hemorrhage.

*Bret* has never been able to observe any therapeutic influence of bloodletting in the presence of aneurism. In the cases in which he employed the procedure, cyanosis decreased for the time being, but he could not procure any lasting effects, and was unable to check the continuance of the vascular dilatation and its ultimate pressure.

Bloodletting is but one of the possible remedial agents in aneurism, and it is evident that only a certain proportion of cases of the affection are suited for this treatment. It is as yet impossible to state in which cases blood may be abstracted and in which withdrawal is contraindicated. That much, however, may be declared with certainty, that frequent periodical bleedings of about 100 c.c. (3 ounces) will do more in keeping down intravascular pressure and repairing the injury than the abstraction of 500 c.c. (1 pint) of blood or more at one time.

It seems hardly necessary to set forth that without the other approved measures for the treatment of arterial dilatation, preeminently rest and proper diet, bloodletting can never avail much in this affection.

In dilatation of the veins general bloodletting has but rarely been resorted to by latter-day practitioners. Topical bleeding, on the other hand, has many advocates. *Schubert* asserts that he has succeeded in materially reducing varices and hemorrhoidal tumors by withdrawing blood directly from them through a punc-

ture. Many clinicians, among others *Welsch*, report excellent results in hemorrhoids by placing from six to twelve leeches near the anus. For the local abstraction of blood in hemorrhoids leeches are often preferred to wet cupping or scarification.

#### D. Edema of the Lungs

Pulmonary edema is not an independent affection, but a symptom of various pathological processes. However, it is a symptom of such moment that it requires a separate discussion. It may seem strange if I again approach the subject of pulmonary edema after the several references to it under the heading of pneumonia. It should be borne in mind, however, that pulmonary edema is not primarily a manifestation of an affection of the organs of respiration, but that it is a phenomenon due to a disturbance of circulation. After all, pulmonary edema is but an infiltration of serum from the engorged capillaries into the air-cells and alveolar walls, which may originate from affections of the lungs as well as from morbid processes in the heart and circulatory diseases in general. In case even the pulmonary transudate is the result of a disease of the lung itself, it is a menace to life, for the reason that it eventually inhibits cardiac activity. No matter whether the underlying cause of the edema is a pneumonia or a primary cardiac insufficiency, the invariable result is a venous stasis in the lesser circulation, which cannot be overcome by the heart unless assisted by a timely and sufficient withdrawal of blood. Thus the clinical picture is complicated by the production of the portentous vicious circle; the hydropic infiltration intensifies the pulmonary congestion; the latter in turn again increases the transudation of serum into the air-cells, thereby further im-

peding the blood current in the lesser circulation and the interchange of gases taking place through its medium, until the latter ceases altogether and the heart fails in the vain attempt to overcome the obstructions in the lesser circulation.

To avoid repetition, I will note here briefly that even when pulmonary edema supervenes independently of pneumonia, when, in other words, it is not caused by an inflammatory process, but by an engorgement, bloodletting should not be regarded as a measure of last resort. On the contrary, it is a remedy that should be early employed, i.e., as soon as dyspnea and cyanosis become in the least pronounced. The pulse and the body temperature play here a subordinate rôle. After an abundant bloodletting, relieving the embarrassed heart by removing the pulmonary congestion, the clinical picture often changes with surprising rapidity. This contention is borne out by the observations of many authors. At any rate, bleeding may sever the Gordian knot, that is, it may break the maleficent vicious circle, without which recovery cannot possibly take place. In cardiac debility, bloodletting, performed at the proper time, may even avert venous stasis and pulmonary edema. I will refrain from citing here some pertaining interesting cases from my own practice, for fear of unduly enlarging the compass of this book.

### III. UREMIA

#### A. Acute Uremia

The history of the theories of uremia is virtually the history of the evolution of the autotoxic theory. Successively, almost all the excrementitious matters, carbamid, tartronyl-cyanamid, ammonia and its carbonate, creatin and creatinin, leucin, urochrom, pigmentary substances, and the potassium salts, alone, or by their concerted operation, have been held responsible for the production of the uremic state.

Abundant evidence, however, has been furnished that none of the retained, known products of metabolism are in themselves toxic in any degree. Some of the most experienced clinicians maintain that uremia is not the result of the retention of one specific urinary constituent, but of a number or of all such substances. Practically the same view is held by *Bouchard*, according to whom uremia is not the consequence of a single toxic principle, but the product of all those retained substances which normally enter into the composition of the urine.

The physico-toxic theory of the causation of uremia is based upon the frequently observed fact that there exists an augmentation of the molecular concentration of blood serum in uremia, and upon the additional assumption that this higher concentration is due to accumulation of normal products of retrograde tissue metamorphosis.

If there occurs no synchronous decline of the general metabolic processes, or if no, or but insufficient vicariousness is displayed by other emunctories when the excretory activity of the kidneys, the organs para-



mount in depressing the osmotic tension of the blood, is diminished or totally suspended, the crystalloid substances rapidly accumulate in the serum, causing it to be hyperosmotic.

It is probably out of place on this occasion to go into details concerning that which I have called the physico-toxic basis of uremia. Those interested in the subject I refer to my book on "The Autotoxicoes." In order, however, that the *modus operandi* of bloodletting and that of a subsequent saline infusion in uremia be properly understood, I deem it essential that the facts pertaining to the physico-toxic theory be briefly summed up, as in the following:

1. None of the retained known products of metabolism are in themselves toxic in any degree.

2. In uremia there is a higher molecular concentration of the blood serum which is due to the accumulation of normal products of catabolism.

3. Hyperosmosis of uremic serum is evidenced by determination of its freezing-point. The freezing-points of normal blood sera lie between  $-0.55$  and  $-0.57$  deg. C., those of uremic blood sera are depressed to between  $-0.61$  and  $-0.67$  deg. C.

4. In uremic serum there invariably occurs an abnormally large amount of retained nitrogen. There is no parallelism between the degree of freezing-point depression and the amount of retained nitrogen.

5. Non-electrolytes do not only interfere with complete dissociation, that is ionization, but also retard ionic movement. Their presence, therefore, lessens the electrical conductivity of the watery liquid in which the electrolytes are contained.

6. In uremia the large amounts of retained albuminous derivatives exhibit most potent non-electrolytic qualities.

7. The ions as independent molecules participate in augmenting osmotic tension and in depressing the freezing-point; the excessively high osmotic pressure of uremic serum is not due to its ions, but to its contents of neutral molecules.

8. Determination of the freezing-point of uremic serum discloses the fact of its high molecular concentration, but not the degree of its electrical conductivity.

9. Dissociation of electrolyte molecules into ions occurs in the ratio of the dilution of the watery solution. The more concentrated the serum the smaller its conductive qualities.

10. The conductivity of the blood serum of healthy individuals varies between 106.18 and 119.12. In certain cases of uremia it may fall below 100.

11. In most instances of uremia, especially in those characterized by deep and prolonged coma, the body temperature is considerably lowered. This fact also contributes toward reduction of serum conductivity. Elevation of temperature, on the other hand, as long as it is within well-defined limits, tends to increase the conductivity.

A typical case of uremia, according to my conception, cannot ensue unless there is a disturbed osmotic equilibrium. And furthermore, the uremic state is the sum total of the physical pathology of the body fluids. It is in a physical sense that bloodletting, particularly when combined with an intravenous infusion of a sodium chlorid solution, tends to the reestablishment of the normal physical condition, the osmotic equilibrium. In order to avoid repetition, the reader is referred to page 59, where will be found a brief résumé of my studies on osmotherapy.

The diversity of opinion as regards various procedures and medicinal agents in the treatment of uremia can only be ascribed to insufficient consideration of the original affection on the basis of which it has developed.

Uremia, though invariably the consequence of a disturbed osmotic equilibrium as the direct factor, primarily is not due to the self-same etiological cause in every instance. It is an arbitrary designation comprising a multitude of phenomena often unlike in character and intensity in various patients and in the same patients at different periods. True enough, all uremic manifestations depend upon the condition of the body fluids, especially the blood. However, while the blood exhibits some characteristics which are in a measure common to all the types of uremia, the serum of every variety possesses some distinctive feature. Responsible for this is not only the different underlying renal condition, but also the decomposition products of the retained substances, the formation, quantity and specific state of which are dependent upon duration of retention, the state of oxidation, and the physical condition of the serum in general. (Besides, the specific material of the infectious disease in whose wake uremia may appear, may exert some influence upon the physico-toxicity of the serum. This is, however, a negligible factor.)

In the large, white kidney, for instance, the passage of the watery constituent of the blood is seriously interfered with; in contracted kidney there is nothing to prevent the outflow. While at the approach of and during the uremic condition extremes in blood composition may not exist any longer, the sera of uremia on the basis of chronic parenchymatous nephritis are differently constituted in some major points from

those of uremia due to interstitial nephritis. The tendency to convulsive phenomena in the one, and to a comatose state in the other variety, may well be explained by the different constitution and physico-electric behavior of the respective sera.

It cannot be my object to dwell in this discourse on bloodletting upon all discrepant features of the various uremic sera; however, in order to demonstrate the necessity of a different and more rational management of the various types of the attack, I cannot refrain from briefly alluding again to the retention nitrogen, a factor most conspicuous on account of its presence in large amounts in the uremic serum due to interstitial nephritis and by its occurrence in noticeably smaller quantities in the serum of uremia following chronic parenchymatous nephritis or the mixed form of the affection.

Under retention nitrogen in the blood is understood all the nitrogen remaining in the liquid after complete removal of the albuminous substances. The average amount of retention nitrogen in 100 c.c. of normal blood serum, according to *Strauss*, is between 25 and 30 mg.; in chronic parenchymatous nephritis without uremia the average quantity amounts to 40 mg., and in the presence of uremia to about 62 mg. in 100 c.c. blood serum; in chronic interstitial nephritis without uremia a mean amount of 82 mg., and when uremia prevailed 130 mg. retention nitrogen was found on the average; in the mixed type of nephritis without uremia in the mean 51 mg., and with uremia 120 mg. retention nitrogen in 100 c.c. blood serum was demonstrated. These figures show that in the blood serum of chronic parenchymatous nephritis about thirty-five per cent. more retention nitrogen is contained than in the normal liquid; that in interstitial nephritis the retention

nitrogen in the blood serum occurs in twice the amount as in parenchymatous nephritis, and that in the intermediate type of the affection there is contained more nitrogen than in parenchymatous and considerably less than in interstitial nephritis. They further evince that the amount of retention nitrogen is increased in the uremic conditions following the three forms of nephritis, and that in the uremic serum in parenchymatous nephritis the amount of retention nitrogen occurs in about half the quantity it is found in the serum of uremia arising as the consequence of interstitial nephritis.

The enormous quantities of retention nitrogen in the serum of chronic interstitial nephritis undoubtedly stand in causative relationship to the natural termination of this disease—uremia. The large amounts of retained albuminous derivatives, as was pointed out heretofore, exhibit strong non-electrolytic properties. In chronic parenchymatous nephritis uremia is not only a much rarer, but also a less grave complication. In more than seventy-five per cent. of the cases of uremia due to chronic parenchymatous nephritis which have come under my observation I have seen recovery from the first attack. The comparative infrequency and mildness of the uremic seizures due to chronic parenchymatous nephritis are explained by the fact of the relatively small amount of retention nitrogen. In other words, in serum of the uremia arising on the foundation of chronic parenchymatous nephritis the slighter quantity of retention nitrogen interferes less with the movement of the ions and does not therefore reduce the electrical conductivity of the serum in the same degree as it usually does in the uremic serum of interstitial nephritis.

The inconsistency of pursuing the same plan of treatment throughout in cases of uremia so unlike in



their manifestations and arising from two (or more) so markedly discrepant substrates is obvious.

Uremia of renal origin is by far the most frequent. However, occasionally uremia of ureteral or vesical causation may ensue. When the ureters are firmly compressed (for instance by the pregnant uterus) or when micturition is prevented by concretions, retention of the urine takes place, and this may lead to uremia. This condition can, however, supervene only then when both ureters are completely obstructed. In total anuria due to ureteral obstruction death may take place within a few hours. Vesical uremia is due to paralysis of the sphincter or a much enlarged prostate preventing the passage of urine from the bladder. Genuine cases of ureteral and vesical uremia are comparatively rare, because morbid processes in the bladder and ureters causing retention of urine are invariably associated with marked anatomical changes in these organs, and are followed by ammoniacal decomposition of the urine and often also by septic phenomena. At any rate the vesical and ureteral forms of uremia, in case the obstruction to the free passage of urine be soon removed, are decidedly less dangerous than is the renal form, as the inefficient kidneys are a constant source of renewed attacks.

Bloodletting has a *raison d'être* only in instances of uremia due to renal disease, and it must be clear to the reader that also here it cannot be regarded as a specific. The cause of uremia, the nephritic condition, is, of course, not removed by bleeding. So long as the renal affection persists, the abnormal state of the blood and the resulting pathologic manifestations will continue. Herein also lies the reason why in chronic uremia (precisely on account of the chronic nephritis) small bloodlettings should be undertaken from time to

time. Nevertheless, bloodletting may under certain circumstances be a life-saving procedure in acute uremia. The most lasting results of the abstraction of blood are obtained in cases following acute nephritic conditions, that is, in such instances in which the patient is still sthenic and in which the blood has not as yet attained that degree of admixture and physico-chemical deterioration which it exhibits during the chronic renal affections. Furthermore, uremic manifestations on the basis of chronic parenchymatous nephritis yield more readily to venesection than those which are due to contracted kidney. In children, abstraction of from 100 to 250 c.c. (3 to 8 ounces) of blood often effects immediate improvement; in adults from 250 to 1000 c.c. (8 ounces to a quart) of blood, according to the condition of the patient, should be withdrawn at one time. When the uremic symptoms do not abide after bleeding, the procedure may be repeated on one and the same day, provided the patient is yet in a comparatively fair condition and the uremic manifestations are the result of an acute renal disease.

The frequent salutary results of venesection in the properly selected cases cannot be ascribed to the abstraction of a few hundred cubic centimeters of "impure" blood and the proportionate quantity of retained nitrogenous material. The cathartic action of bloodletting, its blood-purifying qualities, are either very limited or do not exist at all. The removal of the blood, however, decreases the osmotic tension, and the improvement afforded by it is probably due to nothing else but the relief of the vasoconstriction in the kidneys or in the central nervous system or in both these places.

A more energetic and lasting effect of bloodletting in acute uremia can only be procured when it is combined with an intravenous infusion of a weak saline so-

lution. It is the combination of these two physical remedies that may eventually bring about the reestablishment of the osmotic equilibrium and the physico-electrical conditions in the blood serum.

The intravenous introduction of a weak solution of NaCl dilutes the blood, produces diuresis and compensates for the amount of blood lost by the artificial abstraction. A NaCl solution which is isotonic to human blood contains 0.91 per cent. NaCl. It is the true physiologic salt solution and its intravenous injection after severe hemorrhage is followed by regeneration of the blood plasma and restoration of the normal volume of blood. In uremia, however, it has been observed that an isotonic NaCl solution does not act as efficiently as one which is hypotonic. For this reason a decinormal NaCl solution containing not quite 0.6 per cent. of the salt is usually employed in this condition. This may be understood by remembering that the high osmotic tension of uremic serum is not so much due to its ionized as to its neutral molecules.

To effect a more general ionization and conductivity water only is essential. Additional electrolytes in the uremic serum which are introduced from without are absolutely not needed; however, a solvent to facilitate dissociation of the electrolyte molecules existing in the blood should be infused. As plain water, to be sure, may call forth a too pronounced hypotonicity, and as it acts as a poison to the erythrocytes, producing their crenation, a weak solution of NaCl should be resorted to. I formerly used a 0.5 per cent. and for the last ten years a 0.35 per cent. solution with the utmost benefit to the patient, especially in uremia due to chronic parenchymatous or to acute infectious nephritis.

The comparatively small amount of nitrogenous retentia in the uremic serum in diffuse nephritis facili-

tates the reestablishment of its normal conductivity after the intravenous infusion of the salt solution; on the other hand, in uremia having chronic interstitial nephritis at its foundation, when the retention nitrogen exists in enormous quantities, and when ion formation and ion movement are more or less paralyzed, not alone water but also goodly amounts of active molecules seem to be indicated.

The minimum amounts of the solution to be used should never be less than from 250 to 400 c.c. (8 to 13 ounces). Smaller quantities produce very limited and rapidly passing effects only. The maximum amount of a 0.35 per cent. NaCl solution which may be administered at any one time must in some way correspond to the amount of blood withdrawn. It should not exceed 500 or 600 c.c. (16 or 20 ounces). The procedure may, however, be repeated as often as bloodletting is performed. When a considerable amount of blood has been abstracted it may at times be necessary to repeat the introduction of the saline solution at short intervals.

As serum conductivity is enhanced by elevation of its temperature, additional benefit will be derived if the saline solution when entering the organism exhibits a temperature above normal blood heat. If utilized intravenously it may safely be administered at a temperature of from 45 to 48 deg. C. (113 to 118 deg F.)

It is my experience that phlebostasis has no place in the treatment of an acute attack of uremia. It exerts neither any influence upon the pathologic substrate nor upon the physico-electrical disturbances in the blood. Again, in acute uremia a gross mechanical effect as that upon an embarrassed right heart in pneumonia, for instance, is hardly ever called for. In chronic uremia, on the other hand, such mechanical influence may

be absolutely necessary in order to overcome a critical period.

### B. Chronic Uremia

Insidious is the onset of chronic uremia, slow its progress, varying its duration and the prominence of individual symptoms in different instances.

The syndrome of chronic forms of uremia consists, apart from the general bodily depression and renoangiocardiac enfeeblement, mainly in disturbances of the nervous system and the digestive apparatus. The principal nervous symptoms are of a psychical nature; *Frerichs*, as early as 1852, has vividly described them, as follows: "In a patient affected with renal disease, mental inactivity and somnolence are frequently noted even in the early stages. The patients complain of dull headache or mental confusion; their eyes become dim and expressionless, their features flabby, they live without taking interest in others, are forgetful and indifferent, and their movements are sluggish and languid. These phenomena may occasionally abate or may entirely disappear for a time. Mostly, however, they gradually gain in intensity; somnolence slowly changes to stupor; at the onset the patients may still respond to loud calls, or to shaking, and will give rational answers; later on coma supervenes, the breathing becomes stertorous, to be followed by the terminal respiratory rattle. In the majority of cases the stuporous lie quietly and do not talk; when delirium supervenes, the patients mutter a few words or sentences, repeating them frequently. Death is often preceded by muscular twitchings and convulsions." The leading disorders connected with the alimentary tract are lasting anorexia and nausea, and occasional vomiting, ensuing at first after eating or in the morn-



ing on awakening only, but later also during the day in the presence of an empty stomach. Dryness of the mouth and trachea are frequently complained of by the patients, as are intractable diarrheas which, however, must often be ascribed to compensatory intestinal activity.

Of the respiratory disturbances irregularly accelerated breathing is probably the most important in the presomnolent period; other respiratory impediments in the course of chronic nephritides are generally due to organic changes in the bronchi, lungs or heart muscle. In the comatose state, stertorous breathing ensues sooner or later, and Cheyne-Stokes respiration supervenes not infrequently.

The skin, usually dry, is often the site of more or less itching, and of various vasomotor events, as the doigt mort (dead finger), with formication or spasmodermia. Exhalations from skin and lungs may have an urinous, non-ammoniacal odor. The urinary excretion is generally diminished, especially shortly prior to or during an exacerbation. There is never an increase of body temperature; even when there exists an association with a febrile disease temperature elevation may not occur. On the other hand, decline of body temperature is a common incident in the chronic uremic state.

This brief account of the salient clinical features of chronic uremia may serve as an introduction to the following.

The contention of numerous clinicians that in acute uremia bloodletting is often a life-saving procedure is gradually arresting the attention of the modern medical world. Real opposition to this remedial agent, so far as acute uremia is concerned, does not exist any longer, and the scepticism still prevailing in some

quarters is due far more to inexperience with than to inefficiency or irrationality of the procedure.

Chronic uremia, on the other hand, is almost virgin soil as regards therapeutic blood abstraction; moreover, some of the clinical reports in literature dealing with the subject either do not ascribe any or no significant influence to the operation. I must confess that I formerly held somewhat similar views. In my book on autointoxication, for instance, I said: "In asthenic and far-advanced cases abstraction of blood is not only useless as a rule but often even injurious." It stands to reason that the results of any therapeutic intervention are not as striking in chronic forms of uremia which have arisen on the basis of long-continued renal disease, as in uremia suddenly developing in the course of an acute or subacute kidney affection. In the latter instance bloodletting is frequently followed by abatement of the threatening manifestations, and the underlying nephritic process may yet be ameliorated. In the former conditions the proper period for interference by withdrawal of blood is nearly always missed; the body organs in general have too far deteriorated; the renal degeneration is beyond repair. To defer bloodletting in a case of chronic uremia until convulsions or coma has supervened means that, at the best, but exceedingly transient improvement may be hoped for.

The indications for blood abstraction in acute uremia are, generally speaking, abnormally high blood pressure with marked vascular tension, congestion of certain organs, and the accumulation of catabolic products in the blood. So far as the congestive conditions and the physico-catabolic toxicosis are concerned they are practically the immediate forerunners of every form of chronic uremia. Without their occurrence a

succession of acute exacerbations might be encountered, but a chronic uremic state would not exist. On the other hand, though excessively high blood pressure and vascular tension are likely to have existed in a previous period, they are rather the exception in the long-established chronic uremic event. In reality, there has supervened a decided enfeeblement of the circulatory system in a majority of instances of chronic uremia. Is this fact to be looked upon as a contraindication for bloodletting? A question as important as this cannot be decided by mere theoretical considerations, but has to be answered by clinical experience.

Of whatever nature the immediate causes of acute or chronic uremia may be, that much may be claimed with certainty, that it is neither the high blood pressure in the one nor the generally decreased pressure in the other instance. Abstraction of a few hundred cubic centimeters of blood in acute uremia either does not depress the blood pressure at all, or not appreciably. Besides, a decline in blood pressure which hardly ever exceeds from 5 to 15 mm. Hg. after removal of about 200 c.c. blood, is but a transitory occurrence; after a few hours the blood pressure is again the same as it was before depletion. Nevertheless lasting benefit often results for the patient. On the other hand, pulse tension frequently declines after bloodletting, and this fact may, in a measure, explain the therapeutic action of the procedure. There ensues in uremia also a constriction of the renal blood vessels by irritation of the vasomotor center. This constriction causes slowing of the renal circulation and consequent alteration in diuresis. Abstraction of blood alleviates the vasoconstriction in the central organ or the kidneys, and diuresis becomes augmented (*Walko*). Bloodletting is

not followed by increased quantities of urine if employed in other affections. However, suppression of vasoconstriction after depletion is also a more or less evanescent occurrence and the lasting benefits often resulting from the operation must be ascribed, in part at least, to some other factors. In this connection the physical conditions in the blood and the increased oxidation following bleeding may be mentioned. Hematocatharsis, as previously pointed out, either does not ensue at all or is of subordinate importance.

In the genuine forms of chronic uremia no augmented pulse tension is found, as a rule, and there exists no clinically demonstrable constriction of the renal vessels. The oliguria, rather moderate in many cases, is due in great measure to diminished intake of liquids and retarded catabolism. While, then, striking effects as afforded by relief of vasoconstriction, cannot generally be attained by bloodletting in the chronic forms of uremia, a partial reestablishment of the osmotic equilibrium, evinced by an increased flow of urine, by diarrhea and especially by diaphoresis, and increased oxidation processes may follow in the wake of this therapeutic agent. There will often ensue a comparative physical detoxication which, of course, can neither be complete nor permanent on account of the irreparable condition of the kidneys. Furthermore, nothing speaks against systematic repetition of judicious blood abstractions in most of these cases, and thus the life of the patient may be prolonged for weeks and even months.

A patient of mine, a man 63 years old, affected with chronic interstitial nephritis, with frequent symptoms of chronic uremia, was bled by me every six weeks, on the average. Generally from 200 to 300 c.c. (7 to 10 ounces) of blood was removed at a time. Venesection

was nearly always performed at my office. The patient lived for almost four years after instituting this mode of treatment.

A patient in the state of chronic uremia is practically moribund; it is only a question of time, often only of hours, when the terminal convulsions or coma supervene. Routine treatment by medicaments and physical agents like sweating, if continued for too long a period, causes diminution of the transudations and consequently higher concentrated solutions of the catabolic substances. Such treatment virtually may provoke the onset of uremia, an event which is not induced by the transient diaphoresis and diarrhea following the abstraction of blood. Moreover, blood abstraction in chronic uremia may and should be followed by an infusion of a hypotonic salt solution which may facilitate the reestablishment of a disturbed osmotic equilibrium. Again, medicines employed in the presence of renal insufficiency exert cumulative action, and the mental excitement, vomiting and convulsions ensuing in chronic nephritics after prolonged administration of digitalis, for instance, must be ascribed to the effects of the drug in a goodly number of instances. These phenomena belong to the syndrome of chronic uremia, are probably part and parcel of uremia, but are of toxic and not of autotoxic origin.

There exists no specific contraindication to blood-letting at any period of chronic uremia, and as the patient is virtually in a hopeless condition, the therapeutic procedure should always be given a trial to stay for a while the approaching dissolution.

In a noteworthy article upon the indications and contraindications of bloodletting with subsequent saline infusion in uremic disturbances, *Reitter* con-



siders this question from his point of view. His observations confirm the assumption that certain interrelations exist between the various forms of nephrosis and the separate uremic disorders (to which eclampsia is counted by most authors). An exact knowledge of the functional capacity of the kidneys is the first requisite in this therapy. In all the nephroses with uremic manifestations a favorable influence of bloodletting combined with an isotonic (hypotonic) salt infusion is noted, but the ensuing reaction varies in degree in different cases. Contraindications, according to this author, are: seriously impaired heart, extensive destruction of pulmonary tissue, pronounced arteriosclerosis (especially of cerebral arteries), preceding heavy loss or abnormal composition of the blood. According to *Reitter* these contraindications apply also to all forms of nephrosis. With regard to abnormal composition of the blood I would like to state that, beyond doubt, there are cases in which it does not constitute a contraindication, but e contra an indication for bloodletting combined with an infusion of a weak saline solution.

Phlebotomy and infusion complement each other in their effects and should, therefore, be always employed together in uremic conditions. Edemas form no contraindication against saline infusion, nor an impediment to the satisfactory absorption of the infused fluid. Infusion of a large volume of fluid, but never more than from 250 to 350 c.c. (8 to 12 ounces) at one time offers an opportunity to dilute the tissue fluids, and facilitates, if even only for a brief but critical period, a reestablishment of physical conditions in the blood serum approaching the normal.

In the uremic disturbances of the acute nephritic states combined bloodletting and infusion is an ef-

ficacious remedial measure ameliorating also the underlying affection. For this reason, this combined therapy is unconditionally indicated in such cases. In the uremic disturbances of the chronic forms of kidney disease the favorable effect of bloodletting and infusion depends upon the degree of the anatomical impairment of the kidneys, as principally evidenced by the quantity and quality of the renal epithelium found in the urine. In those forms which show only a minor atrophy of the renal parenchyma, the result is good, but not lasting. In the acute exacerbations of these forms, bloodletting and infusion are indicated as soon as uremic manifestations have supervened. In the forms of renal disease in which is encountered pronounced atrophy of the kidney parenchyma, the reaction is so insignificant and transitory that bloodletting and infusion are hardly indicated; they may, however, be used symptomatically for the purpose of relieving certain uremic manifestations, as headache, for instance.

I will now deal with the questions how much blood should be withdrawn, and when and how often should blood abstraction be undertaken in chronic forms of uremia.

While in acute uremia from 250 to 1000 c.c. (8 to 32 ounces) of blood should be withdrawn at a time, the quantity to be abstracted in chronic forms of uremia should be decidedly smaller. It must not be forgotten that the symptom-complex with which one is here confronted is, as a rule, due less to vasoconstriction than to chemico or physicotoxicity, and that the less violent manifestations of chronic uremia do not necessitate withdrawal of as much blood as do the stormy symptoms of the acute form. Besides, the deteriorated condition of the patient has to be taken into due considera-

tion. The amount of blood, then, to be abstracted at the first attempt should be about 1 c.c. for each kilogram (7 drops per pound) of body weight. In subsequent depletions the amount of blood may be gradually raised, but it should on no occasion exceed 2 c.c. for each kilogram (14 drops per pound) of body weight. The small quantity of blood thus removed from the organism makes blood abstraction a perfectly safe procedure, even in patients with long-established kidney disease.

As soon as the true state of affairs is recognized, viz., that the nervous, digestive and respiratory phenomena arising in the course of chronic renal disease are due to the latter, bloodletting should be performed. Appearance of the triad—dull headache, mental confusion and somnolence on the basis of a long-established nephritic state—compels quick decision. The earlier blood abstraction is carried out, the more pronounced and lasting will be its therapeutic effect. If the uremic symptoms do not abide to a great extent, bloodletting may again be performed on the following day. If the patient's condition demands it, blood should be abstracted every week or, in exceptional cases, even oftener. In other instances fortnightly or still more infrequent blood abstractions may suffice to obviate approaching convulsions or coma. The blood may be withdrawn at any period during the twenty-four hours, but the patient should, as a rule, rest in bed, well covered, for at least six hours after bloodletting. A hypotonic saline solution, as repeatedly mentioned, should be combined with the depletion. The most simple manner in which venepuncture and infusion may be combined has been dwelled upon at length in the chapter on the technic of bloodletting.

In chronic uremia, a forlorn cause, we cannot expect

bloodletting to accomplish wonders. Yet, it is a potent and withal a safe remedy, one that should be resorted to in many instances of the affection. It may not disperse all the uremic manifestations, but it is likely to put a temporary check on one or the other. It is frequently attended by a recreative sleep, after which the patient regains consciousness. Impending convulsions are prevented, active convulsions often suppressed; respiration is generally regulated; temperature increases temporarily and pulse frequency diminishes as a rule; diuresis is mostly augmented, and urinary albumin and renal elements may be excreted in lesser amounts. The life of the patient is spared for the time being, and this is all we can look forward to in chronic cases of uremia.

An article by *Morawitz* deserves mention in this place. This author is of the opinion that in the auto-toxicoses, especially in uremia, a lasting improvement cannot be obtained by means of bloodletting so long as the underlying affection, in most cases nephritis, continues. That, of course, is quite true, for bloodletting only eliminates a comparatively small amount of the retained metabolic products. Moreover, the limited benefit thus procured is soon lost again by the continued retention of newly-formed substances of retrograde tissue metamorphosis. He admits, however, that bloodletting in an autotoxicosis like uremia may avert immediate danger to life by reason of changes in the relations between the blood and tissue fluids (re-establishment of osmotic equilibrium). On the other hand, he maintains that a permanent improvement may be ascribed to venesection in acute ectogenous intoxications which have not as yet produced any organic changes, for "in such cases the pathological condition is removed together with the intoxication."

Phlebostasis, especially when combined with respiratory exercises, has a distinct place in the management of cases of chronic uremia. It has, of course, no influence upon manifestations like the suppression of the urine, for instance. However, it often successfully overcomes the difficulties that engender symptoms on the part of the heart, the nervous system, the digestive apparatus, the respiratory organs and the skin. Nothing equals the repeated application of the phlebostate in "renal asthma." In uremic headache the procedure may be applied as often and as long as necessary. It never leaves any undesirable after-effects, which cannot be said of other physical remedial agents or of drugs in general. In uremic vomiting it has rendered me extremely good service. Inasmuch as deep breathing is so much facilitated under phlebostasis, I order the patients with symptoms of a gastrointestinal character to expand and contract their chests as much as possible. Vomiting is often stopped in this manner at once. Nausea, which is met with in nearly every instance of chronic uremia, is often relieved for from six to twenty-four hours. No matter of what nature the symptoms may be, phlebostasis is never contraindicated in any of the types and stages of chronic uremia.



#### IV. PUERPERAL ECLAMPSIA

Although, generally speaking, similar viewpoints obtain in eclampsia as in uremia, yet there are certain peculiarities in connection with the former that demand some special consideration. The modern practitioner of medicine may assume it as an established fact that the disturbances of consciousness and the convulsions of the entire musculature, so characteristic of eclampsia, are the direct result of grave functional disorders of the kidneys and the liver which, beyond doubt, are called forth by the state of pregnancy. As to the nature of these disturbances, however, the opinions vary. *Schmorl* on the basis of his pathologico-anatomical investigations concerning puerperal eclampsia has advanced the theory that the migration of placental cells into the maternal circulation poisons the blood and provokes renal inflammation and eclamptic manifestations. *Zweifel*, however, is of the opinion that eclampsia is due to the retention of urine owing to the pressure exerted by the gravid uterus upon the ureters. Much is to be said in favor of this theory, since we know from experience that the rapid termination of pregnancy or of the act of parturition—if need be by operative interference—is followed by the disappearance of the threatening symptoms. Occasionally the emptying of the uterus ensues too late; in such cases the physico-chemical disturbances in the body fluids have progressed to such a degree that the termination of pregnancy cannot be of any avail as far as the suppression of the eclamptic condition is concerned, or the physico-chemical alterations do not supervene until the fetus has been expelled. In instances of this kind blood-

letting has the same effect as in uremia, and it makes no material difference whether the eclampsia has arisen on the basis of urinary retention, or whether it has proceeded from the placenta.

The symptom-complex of eclampsia resembles so much that of uremia that one readily understands the conception of the many authors who see in eclampsia nothing else than a uremia of the pregnant, the parturient or the puerpera. Although complete anuria may not be present, the volume of urine is always considerably lessened; a reduction to 50 c.c. ( $1\frac{2}{3}$  ounces) in the twenty-four hours is by no means rare. Increased pulse tension, higher—later on subnormal—temperature, deep coma, convulsions and Cheyne-Stokes respiration complete the clinical picture. Exhaustion psychoses and contracted kidney are not infrequently sequels of puerperal eclampsia; likewise, aspiration pneumonia and pulmonary gangrene in case food has been administered through carelessness by the mouth while the eclamptic patient was in a comatose condition.

Hence arises the urgent necessity of examining the urine of the pregnant and parturient woman. If albumin be found or hydropic infiltration of the subcutaneous tissues of the eyelids, the ankles, etc., absolute rest in bed, a milk regimen, and the proper medicinal agents should be prescribed; in case the symptoms do not abate, rapid and forcible delivery or bloodletting should be undertaken. If threatening symptoms of eclampsia have already supervened, and if for special reasons forced delivery is not advisable for the moment, phlebotomy should be performed at once. This, in any event, is always the safest and most reliable remedy in eclampsia during any time of the puerperium. As eclampsia generally ensues in robust

women, 500 c.c. (16 ounces) of blood may safely be withdrawn. The convulsions almost always subside promptly, consciousness returns, headaches, albumin and anasarca disappear, and the urine increases in volume, sometimes to three or four liters (three or four quarts) in the twenty-four hours.

Up to about the middle of the last century bleeding was the universal remedy in puerperal eclampsia. At this time the reaction set in. *Braun*, then the professor of midwifery at the University of Vienna, although not "disposed to consider the old treatment by bleeding as having been so bad and absurd as it is now (1857) often called," nevertheless gives expression to his disbelief in the efficacy of bloodletting by stating that in uremic eclampsia, depletion readily gives rise to an injurious effect, "because the cyanosis of the face coming on in eclamptic women is only a consequence of the spasm; because, by bleeding, the hydremia is further increased, the nervous fits are not improved, puerperal thrombosis and pyemia in childbed are much to be feared; and because, not infrequently, the paroxysms are aggravated by it, and exhaustion, fainting, and very slow convalescence are thereby produced." He modified this paragraph, however, by setting forth that in properly selected cases bloodletting is not harmful if the patient is a strong, full-blooded woman, when there is very marked pulsation of the carotids, and the face is still dark-red some time after the convulsion, and pulmonary edema is imminent, and when there exists no anemia, chlorosis, and physical exhaustion.

With Cazeaux this obstetrician is of the opinion that the production of hemospasia (Junod's boot) is much more rational than profuse bleeding. His reasons are that by this method, which virtually amounts to phlebotomy, the blood is only withheld for a brief period

from the circulation, and "the production of a transitory edema of the extremities may free the blood for a certain time of morbid and altered serum."

According to *Veit*, a modern investigator, eclampsia proceeds from the placenta. This author hopes that in time a specific antidote (antitoxin) will be found. In the meantime, the eclamptic patients must be treated by the best and safest means at our disposal. If the results obtained by the various methods now in vogue are compared, the advantages accruing from quick delivery combined with venesection and narcosis are at once evident. It is *Veit's* opinion that the source of toxicity in eclampsia, the placenta, be removed by a speedy anterior hysterotomy; furthermore, that the toxins already present in the blood be eliminated as much as possible by bloodletting, and that the convulsive state be combatted by narcotics. Whether it is more advisable to first terminate pregnancy and, in case but little blood has been lost, to proceed at once to withdraw about 500 c.c. (16 ounces) of blood, or to perform venesection first and then the accouchement forcé, depends entirely on the circumstances of each individual case. The conditions are most favorable, according to the same authority, when immediately after the first attack, before the state of the blood has been too much impaired, the combined method of obstetrical operation, venesection and narcosis is being utilized. In case heart disease offers no especial counterindication, *Veit* prefers chloral hydrate to procure narcosis, as recommended by Stroganoff. Bloodletting is not required when after the rapid and forceful delivery convulsions have ceased to supervene. The foregoing evinces that the modern treatment of puerperal eclampsia, irrespective of its cause, is in general the same. Indeed, most obstetricians do not inquire at all

after the underlying cause of a puerperal eclampsia with which they chance to be confronted. Thus, *Broadhead* is solely guided by the clinical features of the case. He declares that venesection is of distinct value in instances where the pulse is strong and full with high tension. When delivery is imminent, he continues, the patient may be bled during the placental stage of labor, or immediately after the termination of the third stage. *Zinke*, in a even more recent publication, entirely occupies the standpoint of *Fordyce Barker* as regards the indication for bleeding in puerperal eclampsia: "When the attack occurs before labor, if the pulse be strong and hard with fulness of the vascular system, and when the appearance of the face indicates vascular congestion, bleed at once." *Eisenreich*, the latest exponent of bloodletting in puerperal eclampsia, follows in the footsteps of *Zweifel*. Like the latter, he either withdraws 500 c.c. (16 ounces) of blood at one occasion, or he bleeds twice, removing each time 300 c.c. (10 ounces) of the liquid. As regards the production of eclampsia he is an adherent of the fermentin-intoxication theory of *Hofbauer*. The following mortality statistics of puerperal eclampsia from the *Universitäts-Frauenklinik* of Munich for the last 73 years, is taken from his article:

PERIOD	TREATMENT	NO. OF CASES	MORTALITY PER HUNDRED	
			Mothers	Children
1862-1890	Absolutely expectative. Chloral hydrate. Chloroform narcoses.	73	35.98	38.88
1890-1906	Gradual introduction of rapid delivery. Chloral. Morphin narcoses.	94	23.4	30.3
1906-1912	Invariably rapid delivery. Chloral. Morphin.	153	17.64	26.75
1913-1914	Watchful waiting. <i>Bleeding</i> . Chloral. Morphin.	43	13.9	23.07



According to *Iarzew* the blood in puerperal eclampsia is loaded with globulins which leads to an engorgement of the arterial circulation as the free passage of the blood through the capillaries is interfered with. An increase in the intracranial pressure is the natural result. It is this augmented cerebral pressure which gives rise to the typical attacks of eclampsia. If the passage of globulins into the blood continues and the attacks are frequently repeated, toxemia may supervene as the consequence of an excess of products of incomplete protein oxidation in the blood. In the severest cases, eclampsia sets in with manifestations of toxemia. In therapeutic respects, this author recommends the employment of narcotics, the acceleration of labor and bloodletting with subsequent NaCl infusion. Whether vaginal Cæsarian section should be undertaken, or whether it is wiser to wait for a possible natural adjustment without resorting to this operation, depends largely on the surgical skill of the attending obstetrician, and on the severity of the eclamptic attacks.

In a general retrospect, *Siegel* compares the various opinions as to the pathogenesis and management of puerperal eclampsia. So far as therapy is concerned, he emphasizes the fact that forced labor and the Zweifel-Stroganoff method (venesection and chloral hydrate) represent the greatest advance in the treatment of eclampsia.

According to *Uthmöller* bloodletting is vastly superior to any other method of treatment in eclampsia. The reason why its employment has been neglected for so many years is due to the fact, as this author maintains, that the results obtained did not in general come up to expectations. He avers that satisfactory results cannot be obtained when the operator is too timid to

withdraw sufficient amounts of blood, and that the discarding of bloodletting in obstetrical practice was mainly due to the hematophobia of the accoucheur of the past generation. In puerperal eclampsia, he declares, bloodletting must be copious (1000 to 1200 c.c. = 32 to 40 ounces). The blood, however, should not be withdrawn until after parturition. Administration of chloral hydrate should go hand in hand with the abstraction of blood, but its doses should gradually be decreased. It is its prompt action which, according to the same observer, renders bloodletting a unique remedy in puerperal eclampsia. In six out of eight cases of grave eclampsia, the convulsive phenomena ceased abruptly after the withdrawal of sufficient amounts of blood.

On the basis of his own researches, *Labhardt* opposes the views of Veit and other investigators according to which eclampsia is of placental origin. He proceeds mainly from two facts: (1) The pathology of animals knows no eclampsia in the sense of human eclampsia; animal experiments are, therefore, a priori illusory. (2) In the human female relatively large numbers of placental cells are absorbed in cases of tubal abortion and eclampsia does not ensue as might be expected in accordance with animal experiments. As regards the therapy, this clinician agrees that the eclamptic convulsions should be combatted by Stroganoff's method, bloodletting and forced labor.

## V. NARCOMANIA

The experienced clinician has long since recognized the fact that we do not possess nor that we are likely ever to number among our assets a specific drug or procedure for the cure of the habitual use of alcohol, morphin, cocain or other narcotic agents. In advancing bloodletting as a new means to combat narcomania, I wish to emphatically state right here that it is not a specific, that it is not applicable in every case of the disease and that its eventual beneficial results depend in a great measure upon the adjuvant therapeutic management.

Although bloodletting has been much used, and also greatly abused by our ancestors in medicine, it appears that nobody has ever thought to rationally employ it in overcoming the morbid crave for intoxicants. The only allusions to bloodletting in any way connected with this subject, which I have encountered, is an article by *Torrance*, who has observed the favorable influence of venesection and saline infusion in a case of delirium tremens, and a short note by *Strubell* relative to the case of a morphinomaniac, a subject of hemophilia, who had nearly bled to death as the consequence of an injury, and upon recovery from the latter was also entirely cured of the morphin habit. In connection with this case Strubell tentatively approaches the question whether venesection could not be given a trial in the treatment of the morphin habitu .

On the occasion of the Congress of the American Society for the Study of Alcohol and other Narcotics at Philadelphia in 1909 I have ventilated this question in various respects. The subject material of this chap-

ter is to the greater part taken from my statements made at that time.

I have observed, and no doubt others have also, that alcoholics affected with frequent attacks of hemorrhage, as epistaxis, a consequence of degenerative changes in the walls of the blood vessels, for instance, may temporarily lose the imperative crave for alcohol, and that female narcomaniacs, just after a profuse menstruation, often experience a decided decrease of the morbid impulse for intoxicants, for the time being. In this connection may be cited the case of a woman, 34 years old, who, during an attack of delirium tremens fell down a flight of stairs, injured herself badly on scalp and face and had lost a large quantity of blood before medical assistance could be procured. She recovered from the delirium tremens and the trauma, and for the following year and a half, the period the patient was under my observation, she never evinced any morbid desire for alcohol.

While some maintain that after the loss of a considerable amount of blood psychic factors may play a certain part in the suppression of narcomania, I have held for a number of years that it is the loss of the blood itself which reduces the crave for intoxication.

*Schroeder van der Kolk*, who died in 1862, in his "Pathology and Therapeutics of Mental Diseases," mentions in some of his case histories, what seemed to have been a well-understood fact at his time, that bleeding exerts a calming effect upon individuals subject to states of depression and mania. The narcomaniac who craves for the evanescent relief procured by intoxication and has his periods of morbid depression and exaltation, surely belongs to this category. It is, therefore, surprising that the therapeutic value of bleeding in inebriety and narcomania in general has

not been recognized by those who are most interested in the study and the cure of these diseases.

In acute alcoholic intoxication elimination of the poison is probably the chief object of treatment; inducement of sleep is the second paramount remedial necessity. The fundamental treatment of chronic alcoholism as well as of morphinism and cocainism consists in the procuring of absolute mental, and often also of physical, rest. Our main endeavors in the management of narcomania should be directed toward the promotion of mental quietude; change of environment, confinement in an institution, hygienic and dietary regulations, drug administration, hydrotherapy, in fact our entire plan of treatment is primarily designed but for one purpose—to induce tranquil relief of mind and soul. In narcomania, which is essentially a chronic disease, the elimination of the poison from and the physical regeneration of the system, though important and arduous tasks, are matters of lesser urgency.

The employment of sedatives, narcotics and hypnotics in the treatment of narcomania is in itself a rather irrational procedure; real mental calmness is hardly ever occasioned by them, and the superficial, brief, interrupted, unnatural sleep they may provoke is not conducive to a moral and physical awakening.

As regards elimination the drugs of this class are not only valueless, but virtually interfere more or less with the catabolic and excretory functions of the organism. To counterbalance this, the emunctories are generally stimulated by additional agents—medicines as well as hydrotherapeutic and other physical procedures—in the hope that thereby the eradication of the poisonous material may be facilitated. There is little doubt that all these ministrations have a place in the treatment of the narcomaniac, but it is an open ques-



tion whether they exert any influence whatsoever in the direction for which they are intended.

By the withdrawal of blood from the narcomaniac there may be induced not alone mental quietude and sleep, but also more vigorous oxidation processes and the reestablishment of an eventually disturbed osmotic equilibrium. We should not forget that the abuse of alcohol is apt to pathologically alter the vascular walls and some of the body organs, and that the physico-chemical composition of the blood, the property of oxygen absorption, the resistance of the blood cells and the general nutritive processes are also liable to undergo morbid changes. Abstraction of blood in suitable cases is invariably followed by a sense of ease and a pleasing, agreeable weakness. A sound, natural sleep of long duration, together with diaphoresis, soon sets in. The patient awakens therefrom refreshed and with a tranquil relief from earthly discomfort and sorrows. Other phenomena, as diarrhea and increased diuresis, also supervene in many instances of bloodletting. The withdrawal of blood may thus be attended by a degree of detoxication of the organism vainly aimed at by medication and hydrotherapy. Augmented processes of oxidation and catabolism ensuing in the wake of one or the repeated abstraction of blood may occasion a complete moral and physical renaissance of the patient.

To illustrate the powerful beneficial influence of bloodletting in certain instances of narcomania I will mention the following case:

The patient, a general practitioner of medicine of a little town in a neighboring state, consulted me in the autumn of 1904. He was in a pitiful condition, exhibiting the characteristic manifestations of morphinomania. He appreciated the deplorable state in which he was, and wanted to make an end of it by committing

suicide. He was 46 years of age, had always led a busy life until about six years ago, when symptoms of what he supposed to be angina pectoris made themselves evident. For the relief of the attacks, which, by the way, had not recurred for the past sixteen months, he had taken morphin in ever increasing doses; he had become a confirmed morphinomaniac in the course of a few months. He had been an inmate of a number of retreats, always for a brief period at a time, and had left each one in disgust and despair.

I told the patient that I had not had any special experience in the management of cases like his, but he responded that for this very reason he wanted me to take charge of it. He opined that I would probably hit upon a plan of treatment which the orthodox specialists could neither conceive nor would execute.

For some time past I had been engaged in the experimental and clinical study of bloodletting, and on mostly theoretical grounds I proposed to the patient to puncture a vein with a specially constructed needle—a forerunner of my present venepuncture trocar—and to abstract about 500 c.c. (16 ounces) of blood. He consented to this, and the same evening I withdrew about 600 c.c. (20 ounces) of blood. He almost immediately fell into a deep sleep after the operation; a profuse perspiration set in soon afterward. The sleep, with occasional brief interruptions, during which he freely took water and milk, lasted for nearly thirty hours. The urine which he discharged during that period amounted to 2200 c.c.; it possessed a specific gravity of 1021.5, and contained no abnormal, but excessive quantities of some of the normal constituents. The patient remained in bed for five days, during which time he experienced for the first time in his life the real “*dolce far niente*”; he felt himself entirely free

from pain and care, talked little but rather optimistically. On the sixth day he walked about the hospital, on the seventh day he took a short walk unaccompanied, and on the evening of the same day, upon his own instigation, another 300 c.c. (10 ounces) of blood was withdrawn. On the tenth day he left for home, a man on the high road to recovery. Since then he has had no relapse.

It goes without saying that the proper hygienic and dietetic treatment was pursued during the stay of the patient at the hospital; he has also adhered to it as far as possible ever since.

Bloodletting is applicable in the great majority of instances of narcomania; in old people, that is in those over sixty-two years, it should be performed in exceptional cases only. Cases of very long standing with far-advanced degenerative changes should not be bled, neither should bloodletting be executed in instances of narcomania which are associated with cachectic states or wasting diseases.

The cases of narcomania suitable for blood abstraction can well spare the necessary amount of the vital fluid. Results may only be expected if a sufficient quantity of blood has been withdrawn; the first bloodletting often decides the issue. The amount to be abstracted at the first operation should not be less than 5 c.c. (a little more than a drachm) for each kilogram (2.2 pounds) of body weight. In rare instances twice that amount may be withdrawn with impunity. From an individual weighing 75 kilograms, i.e. 165 pounds, at least 375 c.c., i.e. 12 ounces of blood, should be removed at the first attempt. In subsequent depletions the amount should be lowered to 3 c.c. or 2 c.c. or even 1 c.c. per kilogram of body weight.

Bloodletting should never be employed as a routine

practice in the treatment of narcomania; it should be reserved for those instances of the disease which have proved intractable to the usual modes of therapeusis. Unfortunately, this is in most cases a sad reality. Obstinate cases and such with a history of frequent relapses should always be subjected to therapeutic depletion at the earliest opportune moment. For obvious reasons, the operation on the narcomaniac should be performed in a hospital or retreat whenever possible. A second, smaller abstraction of blood may be made after six or seven days; thereafter small weekly or bi-weekly depletions, to be continued for two or three months, may prove useful in enhancing the physical condition of the patient. In other instances blood may be abstracted at regular intervals, at about every third or fourth month. The blood may be withdrawn at any period during the twenty-four hours, but the narcomaniac should rest in bed, well covered, for at least twelve to eighteen hours after bloodletting. A hypotonic or isotonic saline solution may be infused after the blood abstraction.

Topical bloodletting as accomplished by leeching, scarification or wet cupping and also phlebotasis are certainly of little avail in a condition like narcomania. Results can only be attained by general depletion. Venepuncture, of course, is always to be preferred for this purpose. However, one must not lose sight of the fact that the prognosis is less favorable the longer the disease has already existed, and that the improvement of the organic and psychic impairments cannot be expected in the course of a few days or weeks.

## VI. OTHER ECTOGENOUS INTOXICATIONS

Besides uremia and eclampsia, which are forms of antointoxication, and narcomania, which is an ectogenous intoxication, there are a number of toxicoses that are beneficially influenced by venesection. In certain of these cases the abstraction of blood is often a life-saving procedure. *v. Jaksch*, who, probably, has had a wider experience with the toxicoses than any other clinician, recounts the poisonous states in which bloodletting is indicated, as follows: Intoxication with carbon monoxid and dioxid, with nitrogen, hydrogen, hydrogen sulphid, arseniuretted hydrogen, nitrous oxid (laughing gas), hydrocyanic acid, nitrobenzol, morphin and strychnin.

Bloodletting, *v. Jaksch* says, is indispensable in poisoning with CO or CO<sub>2</sub>. Since he has learned to apply it promptly he has not lost a single case. He withdraws from 300 to 400 c.c. (10 to 13 ounces) of blood at one time. In poisoning with hydrocyanic acid the physician very rarely has a chance for therapeutic interference, as even minimal doses of the substance are rapidly fatal. However, when *v. Jaksch* found the patient still alive, he succeeded repeatedly to save him by a copious bloodletting. The same happened in cases of strychnin poisoning with very marked cyanosis, also in acute morphin poisoning and all the toxicoses enumerated in the foregoing. This author advises that a saline infusion should follow the venesection, in order to dilute the remaining portion of the poison, to weaken the influence of the poison, and to accelerate its elimination by stimulating the renal activity. In asphyxia, due to poisoning by carbon mon-



oxid or carbon dioxid, hydrogen sulphid, nitrous oxid, etc., it is self-evident that, together with the removal of blood, artificial respiration must be performed and, if necessary, oxygen inhalation be resorted to. There is always one cardinal point that should never be lost sight of, namely, that the blood be withdrawn quickly so that respiratory and cardiac activity is as little interfered with as possible. If the blood has already been overloaded with poisons that immediately form insoluble compounds with certain constituents of the organism or destroy the renal structures, venesection, of course, can hardly be of any avail. It may, perhaps, give rise to a temporary improvement, but the fatal termination can no longer be prevented. Otherwise bloodletting, especially when assisted by other therapeutic measures, has frequently a life-saving effect.

Of five cases of serious poisoning with illuminating gas I was able to save two by means of artificial respiration in the open air, and the withdrawal of 500 to 800 c.c. (16 to 27 ounces) of blood by venepuncture and subsequent infusion of a hypotonic or isotonic solution of sodium chlorid.

In toxemia bloodletting in conjunction with salt infusion is the sovereign remedy. In the chapter on the technic I have already mentioned that under certain circumstances the simultaneous application of phlebotomy and salt infusion may serve a good purpose. This combination method seems to be particularly called for in cases of inhalation of irrespirable gases and other acute cases of intoxication. The danger to life is imminent unless the quickest possible action is taken. The establishment of diaphoresis and diuresis by far occupies too much time. Besides, it must be remembered that a grave nephritic

process may be engendered by the exceedingly violent irritation caused by some of the poisons finding their way into the urine. The rapid removal of such toxic substances from the blood in order to protect the delicate structures of the kidneys can only be accomplished by bloodletting on one arm and a simultaneous salt infusion on the other. The larger the amount of blood withdrawn, the better it will be for the patient. Bloodletting, however, has its limits, and, as has been repeatedly called attention to, profuse artificial bleeding is distinctly contraindicated in certain cases. But if the loss of blood is promptly compensated for in a fashion that renders possible the continuance of the mechanical work of the heart until a regeneration of a sufficient amount of blood has taken place, then, naturally, a decidedly larger quantity may be abstracted than would be permissible under other circumstances. At any rate, it will be worth the while to try out in practice this method (simultaneous bloodletting and salt infusion), especially in cases of acute toxemia of ectogenous origin.

*Schuchardt* and other writers advocate the employment of blood transfusion instead of salt infusion. It is evident that only homogeneous, i.e., human blood can be used for this purpose, and that it must have been derived from an absolutely healthy individual. Of suitable donors there is certainly no dearth. As a rule, even a heavy loss of blood causes little or no injury to the normal, healthy person. Proof of this may be found in the many severe injuries happening in the industrial world, in accidents, battles, duels, etc. Very rarely the wounded bleed to death if timely assistance is rendered. *Hays* speaks of a patient of our acquaintance who has even lost four liters (quarts) of blood by epistaxis without deriving there-

from permanent physical impairment. However, it is a matter of a different nature whether a suitable donor is always promptly available. In acute toxemia every moment is precious. Even a short delay may prove fatal. Where quick, immediate action is required, blood transfusion, despite the brilliant, modern technic, is, therefore, out of the question in most of the pertaining cases. Moreover, it is really not of such urgent importance, as almost the same results may be obtained by a saline infusion which can be administered under any and all circumstances.

That an infusion of a saline solution renders excellent aid when employed together with or after blood-letting in instances of acute poisoning, is attested to by many conservative observers. *Binz* relates a case of phenol poisoning. The patient was already in a comatose state. After the withdrawal of 500 c.c. (16 ounces) of blood and subsequent saline infusion, the patient regained consciousness and recovered. *Hirsch* and *Edel* observed a case of poisoning with phenylhydroxylamin which is of interest on account of the therapeutic effect of the combined bloodletting-infusion method in acute toxemia. A student in a chemical laboratory broke a bottle containing an alcoholic solution of phenylhydroxylamin. The fluid penetrated his clothes and wetted the skin. Within a few minutes after the accident, the student had lost consciousness and the pulse could not be felt any longer. At the hospital he was unsuccessfully treated by means of stimulants and hot water applications. Improvement did not ensue until 300 c.c. (10 ounces) of blood of dark-brown, chocolate-like coloration was abstracted and a NaCl infusion been made. The shape of the blood cells had not been altered, but the hemoglobin had been transformed into methemoglobin. Complete

recovery ensued soon after the patient had vomited large amounts of brown mucus. I will mention in this place that poisoning with phenylhydroxylamin differs in the main from that with nitrobenzol, that in the former the absorption through the skin proceeds much more rapidly.

Many poisonous substances cause alteration of the red blood cells and the oxyhemoglobin. The blood poisons in the narrower sense bring about the change of the normal blood-coloring matter into certain products which, when occurring in more than minimum amounts, do not permit any longer the performance of normal respiration, giving rise thereby to various functional disturbances. Blood thus rendered impure must be removed by copious bloodletting. This, at least, is the opinion of *Lewin*, who believes that bleeding favorably influences the heart's activity for the time being. The same author also advocates an intravenous infusion of a salt solution (0.6 per cent.) with or without the addition of 0.1 per cent. sodium carbonate, but the volume of the infusion should be twice that of the blood abstracted. The blood pressure increases and all the blood disintegration products which, as is well known, accumulate in the renal structures obstructing them, are removed. Indirectly, the same authority maintains, the organism is detoxicated by the administration of an infusion. The hindering of the elimination of the poison by the kidneys is a circumstance aggravating the intoxication. The sooner the free passage through the kidneys is reestablished, which may also be accomplished by diuretics, the sooner will the gravest symptoms disappear.

In the opinion of many clinicians sunstroke or thermic fever is a certain form of acute toxemia. Accord-

ing to *Klein* and *Toussaint* salutary effects are more readily obtained in this condition by phlebotomy and saline infusion than by artificial respiration, skin stimulation, ether injections, and the other usual remedial agents.

Speaking of the toxemias it must be remembered that we distinguish two main groups: toxemia, due to organized bodies, and toxemia as the result of other poisonous substances. Detoxication by bloodletting is only possible when the poisons circulate in the blood and are not attached to certain constituent parts of an organ. (It is possible that bloodletting and intravenous saline infusion will be of material assistance in reestablishing normal blood conditions if but very limited amounts of hemoglobin have undergone alteration; when a larger quantity of the blood coloring matter has become affected, i. e., undergone chemical modification, these remedies are certainly of no avail, *Lewin's* assertion to the contrary notwithstanding.) *Baginsky* is, therefore, entirely in the right when he denies the alleged disinfecting and antiphlogistic properties of bloodletting. Antiphlogosis presupposes the elimination of the factors causing disease. The causation of acute disease, however, is mostly to be ascribed to certain microorganisms which are not removed from the body by bloodletting. They propagate by almost limitless growth and form tox-albumins by inseparably uniting with certain albuminous bodies. Neither the multiplication of the pathogenic microorganisms is inhibited, nor their activity in any demonstrable degree attenuated by the abstraction of blood. Infectious processes are, therefore, not influenced by bloodletting.



## VII. AFFECTIONS OF THE BLOOD

### A. Chlorosis

It has been pointed out at greater length in the historical introduction to this monograph that it was the chlorotic affection that gave the incentive to the revival of bloodletting which at the time had almost entirely fallen into disuse. It has also been related that *Dyes*, the reviver of venesection, was full of misconceptions concerning the physiological action of bloodletting and the various pathological states of the blood.

At the present time chlorosis is considered to be an affection of the blood, consisting in a diminution of the hemoglobin content without a substantial decline in the number of the red blood cells. According to *Eichhorst* the cause of chlorosis is a disease of the blood-making organs, particularly the bone-marrow, occasioning an inferiority of the erythrocytes. These can no longer carry the necessary amounts of oxygen, and thus tissue respiration and nutrition become more or less lowered. *Bunge* traces the origin of chlorosis to an irregular process of assimilation due to a lowered intensity of the digestive juices. It was left to *Grawitz* to declare that chlorosis is practically a phenomenon of hysteria. This contention would stamp the affection as an entirely functional disease which, of course, it is not, as organic alterations can actually be demonstrated in chlorosis. The opinion that chlorosis is in some way related to disorders of the female sexual organs is a more feasible one. In this connection, however, cause and effect must not be confounded, as formerly happened when menstrual dis-

turbances were held responsible for the chlorotic state. Today it is generally recognized that chlorosis is the cause of menstrual derangements, and that these do not stand at the foundation of the blood condition. On the other hand, it is quite possible that irregularities in the internal secretions of the sexual organs (possibly also of the thyroid and other ductless glands) in one way or the other influence the blood production in an abnormal or pathologic manner. *Reithers* has shown that intestinal torpor and stasis are not contributing factors in the causation of chlorosis, as is so often asserted today. He determined the ethereal sulphates of the urine of chlorotics and found them only occasionally increased. For this reason the question of the absorption of noxious material from the intestinal tube, so far as it pertains to the etiology of chlorosis, is rather a negligible factor. The theory that chlorosis originates from increased putrefactive processes in the intestine certainly lacks experimental and clinical confirmation. The theory that a metabolic autointoxication, the consequence of an insufficient internal secretion, underlies the chlorotic blood alteration, appears to be, under the circumstances, the most plausible one. In a measure this theory also accounts for the physiological effects of bloodletting, which latter, so long as the primary cause or causes of chlorosis are still unknown, can, of course, be regarded as a mere symptomatic remedy only.

It seems rather paradoxical that chlorosis should yield to blood abstraction. The inexperienced may deem this a crude and horrid method to employ in the frail and poorly nourished chlorotic individual; he may even go so far as to call the procedure, employed in chlorosis, an act of malpractice. The remedy, of course, is a heroic one, and, I dare say, one is not often

permitted to use it in private practice. It stands to reason, therefore, that it should only be considered a means of last resort, an agent that should be turned to account after all the usual correctives have obviously failed. While bloodletting, as just stated, appears to act in chlorosis only as a symptomatic remedy, it does not differ in this respect from iron, manganese, arsenic, high altitude, etc. All these agents work symptomatically, no more nor less. Again, it is by no means an empiric remedy, as its *modus operandi* in chlorosis is pretty well understood. In chlorosis the blood regeneration is interfered with. The nature of the interfering influence is not definitely known. Possibly it is a deficient endowment of the blood-making organs themselves. This spells inefficiency. The interfering influences may, however, derive from organs not directly participating in hematopoiesis. If this be the case, the system of the organs concerned in blood regeneration is too torpid to overcome the inhibiting influences. This also spells deficiency. The acute loss of blood is the very best of all stimulants of blood regeneration. This is a physiological fact which is daily confirmed in all large clinics. It also holds good in chlorosis, in which it is quite possible that the increase in hemoglobin is comparatively larger than that of the red blood cells. Again it is likely that the special structures presiding over the production of the erythrocytes are not particularly inactive in chlorosis, and that they manufacture these cells in quite sufficient numbers throughout the course of the affection. The therapeutic abstraction of blood incites the sluggish hematopoietic organs; in some individuals more, in others less. Some authors, among them *v. Noorden*, believe that this torpidity, once conquered, will not return.

The amount of blood that *Schubert*, one of the most experienced clinicians in this special field, withdraws varies between 0.5 and 1 c.c. per kilogram (about 3 to 6 drops per pound) of body weight. This amount seems, however, rather small. Favorable results, I believe, can only be obtained if not less than about 100 c.c. (3 ounces) are abstracted from the average chlorotic individual. The procedure may have to be repeated in a certain proportion of the cases. Not less than two or three weeks should intervene between the various bloodlettings.

*Scholz* and *Wilhelmi* as well as *Schubert* and other writers combine sweating with blood abstraction. Artificially induced sweating undoubtedly tends to increase the effects of bloodletting. (In this connection it should be remembered that bloodletting is generally followed by sweating, particularly when the patient is wrapped in woolen blankets, and that some clinicians have ascribed the benefit accruing from bloodletting as being due to the sweating.) These authors employ systematic sweating treatment after the blood has been removed, but *Scholz* asserts that sweating without previous bloodletting also will often yield beneficial results. He as well as *Wilhelmi* believes that sweating relieves the narrow blood vessels. This, indeed, may be one of the effects of bloodletting, but it is neither a primary nor the most potent result. The effects of sweating are in more than one respect analogous to those of bloodletting. Thus it is evident why sweating may contribute toward the efficacy of blood abstraction, and why repetitions of the latter may be less frequently called for.

Instead of the antiquated sweat baths, electric light baths may be employed in conjunction with bloodletting. Every well-conducted modern sanitarium is

equipped with the proper apparatus, and such an institution is the place of preference when a stubborn case of pronounced chlorosis is to be treated.

Phlebostasis, especially when combined with systematic sweating cures, will occasionally also yield good results in instances of chlorosis. Daily applications of the phlebostate for from twenty to forty minutes are necessary for this purpose. Four cuffs, one on each limb, should be utilized, and the patient left in bed, well covered, for not less than one hour after the procedure. Sweating may be induced by a steam-bath or by any other suitable device. Generally speaking, the very worst cases of chlorosis should not be subjected to the bloodless method, but to real bloodletting.

It is always advisable to now and then let the patient take some breathing exercises during phlebostasis. Three or four minutes' deep breathing for every ten minutes of phlebostasis even the most delicate patient can stand. These deep breathing exercises, while the heart is relieved and at comparative ease, are not only invigorating and procure a feeling of encouragement and a sense of physical freedom and elevation, but also through the diaphragm, the most important inspiratory muscle, work directly upon the sluggish blood-making organs in the abdominal cavity. With each deep inspiration the diaphragm descends pushing downward and forward the abdominal viscera. With each deep inspiration the torpor of the hematopoietic organs becomes less and less.

If the supposition should be confirmed that a deficiency of one or more of the internal secretions plays a part in the origin of chlorosis, this inadequacy must be compensated for by organotherapeutic means. Even then, when this hypothesis becomes well-



founded, bloodletting will still render valuable service in the treatment of chlorosis. For, in the first place, it relieves the heart, which is small in most chlorotic patients and not sufficiently strong to move the entire blood volume. Secondly, bloodletting, as we have learned, is by far the most rational and efficient means for the energetic stimulation of hematopoiesis. Thirdly, the assumption that chlorosis is a manifestation of an autointoxication, is in no manner contradicted by the heretofore mentioned hypothesis, for this also presupposes an autotoxicosis, but only explains its origin differently. Whether the assumed toxic substances, which are said to be at the bottom of chlorosis, emanate from the intestinal tract or from some other source, is not so important so long as they are converted into harmless substances or eliminated by bloodletting, i.e., by the stimulation of the general metabolism. Fourthly, bloodletting is not superfluous for the reason that it enhances the action of medications. According to more recent investigations the specific effects of iron preparations seem to consist chiefly in the fact that they provoke a hyperemia of the gastrointestinal mucosa by which the secretion of digestive juices and the absorption of food are promoted. These effects are much more intensified after bloodletting. In all probability organotherapy may also exert a more decisive influence with bloodletting than without it, especially when, in grave cases, it is combined with continued rest in bed and proper care of the regular functions of the excretory organs, in which again it is supported by venesection.

### B. Polycythemia

An increase in the red blood cells in a given amount of blood is known as polycythemia, polyglobulia or

hyperglobulia. There are two forms of polycythemia. One of the forms, termed relative polycythemia, is caused by inspissation of the blood in consequence of the loss of plasma. The other form, the true or absolute polycythemia, consists in an increase of erythrocytes and hemoglobin without synchronous thickening of the blood. On the contrary, the water content of the plasma in such cases is about normal. In most instances of absolute polycythemia there exists undoubtedly an augmentation of the total blood volume, a genuine plethora. It is not as yet definitely known whether or not there may occur a plethora vera with normal blood composition, especially without an increase in the number of red cells in a given volume of blood.

The total amount of blood is subject to various fluctuations. One may differentiate between transitory and permanent, physiological and pathological alterations. This pertains not alone to the diminution, but also to the increase of the blood volume. But while the transitory and permanent, physiological and pathological decrease of the total amount of blood (anemia) is a long-known fact, it remained to more recent times to supplement the theory and concept of anemia with those of polyemia and polycythemia.

Physiological erythrocytosis may appear in the wake of marked loss of water by perspiration, increased respiration, pronounced muscle exertion, etc. Augmentation of the red cells also takes place in persons living at high altitudes or in rarefied air. This erythrocytosis may essentially be due to the stimulus of the diminished oxygen tension in the blood upon the hematopoietic organs. Polycythemia may also result after an opulent meal.

A number of poisons may also give rise to polycy-

themia. This applies especially to phosphorus. In poisoning with CO, benzin and other coal tar products, as acetanilid, acetphenidin, etc., polycythemia has also been demonstrated. The increase of red corpuscles in these cases is, however, only a transitory one and does not concur with an increase in the hemoglobin content. Frequently the latter is even diminished. Protracted exhibition of preparations of iron and arsenic is also said to occasion polycythemia. Certain substances which increase the blood pressure may likewise call forth polycythemia. Among these substances are epinephrin, caffein and strophanthus. It should be remembered, however, that numerous affections characterized by and concurring with high tension, as arteriosclerosis and nephritis, do by no means lead to polycythemia. The polycythemia resulting from the toxic material is presumably only a relative one. It seems to be caused by the thickening of the blood in consequence of vascular contraction.

Pathological erythrocytosis or symptomatic polycythemia has been encountered in quite an array of diseases. It is, however, dubious whether in such instances there is not an accidental concurrence of an increase of red cells and another abnormal bodily condition. In other words, there is a question if the polycythemia is the result of the other pathological state or if the latter stands in any causative connection at all with the peculiar blood condition. More or less marked polycythemia has been demonstrated in cases of acute miliary tuberculosis, influenza, meningitis, scorbut, icterus with cirrhosis of the liver, trichinosis, malaria, chronic interstitial nephritis, Addison's disease, neurasthenia, etc. Polycythemia has been most thoroughly studied and described in connection with cardiac diseases (Tietz), in connection with the

embarrassed pulmonary circulation and general venous stasis, as in emphysema, and in connection with localized venous engorgement, especially in the portal system.

While erythrocytosis is a symptom or a concomitant of another disease process, erythremia is the sole or at least the most essential symptom by which all the rest of a certain syndrome is to be explained. (Erythremia is defined by the modern hematologist as a condition of the blood characterized by an increase in red cells and an almost invariably present plethora.) Erythrocytosis is a symptom in the same sense as is leukocytosis, for instance; it is merely a compensatory reaction, which is called forth by a reduced oxygen tension in the blood current. Erythremia, the other form of polycythemia, is divided by the Germans into erythremia megalosplenica and erythremia hypertonica.

Those who have given most thought and study to polycythemia agree that erythremia may be successfully treated by repeated and abundant bloodletting.

It is, of course, impossible to effect a radical cure by bloodletting alone. The abstracted blood is soon regenerated. While it is a fact that repeated depletions could incite increased blood formation, this has as yet not occurred in any of the reported cases of polycythemia. After the patient has been bled some clinicians place him on a diet rich in vegetables but poor in iron. They also restrict the intake of liquids. Oxygen inhalations and röntgenotherapy of the spleen and bones are said to have given satisfactory results.

*Wagner* distinguishes between primary erythrocythemia and secondary hyperglobulia. In erythrocythemia there is an increase in the oxygen capacity of the blood and the interchange of gases. For this rea-

son, *Wagner* maintains, favorable results can hardly be expected from venesection. In hyperglobulia, however, good effects may be expected in case the primary disease cannot be influenced by any other means. He reports three cases in which the repeated abstraction of 300 to 350 c.c. (10 to 12 ounces) of blood resulted in substantial improvement. One of the cases was a polycythemia following chronic bronchitis and emphysema; the two others were cases of megalo-splenic polycythemia. In the first case the number of the red cells was permanently reduced, while in the other two cases the increase in erythrocytes could only be temporarily suppressed. The alleviation of the subjective manifestations was marked in all the three cases. It is worth noting that the patients were very much annoyed by perspiration and that the latter ceased immediately after bloodletting. Thus, it is shown that the abstraction of blood is not only diaphoretic in its action, but that it may under certain conditions also display sweat-reducing qualities.

The question of polycythemia in all its different forms and modifications is by no means settled. And it will not be definitely adjusted for many a year. In the meantime I am compelled to look upon bloodletting as a relief of polycythemia as an entirely empiric procedure. In some of the types of polycythemia no treatment is really necessary; in other forms, like primary erythrocythemia, bloodletting is certainly out of place, while again in the forms like those described by *Wagner* its beneficial effects, though not deniable are not as yet rationally explainable. If artificial bleeding incites the blood-making organs, an essentiality in chlorosis, how may it yield benefit in a condition like polycythemia?

While bloodletting in polycythemia is therefore con-



sidered by me a wholly empiric operation, its employment is no more empiric than that of a diet of vegetables which is also poor in iron, or of röntgenotherapy, and it is certainly less empiric than the inhalation of oxygen from tanks.

## VIII. MISCELLANEOUS DISEASES

With the exception of erythrocythemia only such diseases are dealt with in the foregoing in the treatment of which bloodletting ought to occupy a foremost or, at least, a prominent place. In the following, a brief review of those pathological processes is given, which are directly or indirectly beneficially influenced by bloodletting, but in which the efficacy of the procedure cannot be counted on with certainty or in which similar salutary results can also be obtained by other therapeutic agents.

### A. Brain and Nervous System

In a previous chapter it has been pointed out that bloodletting may be a life-saving procedure in cases of imminent cerebral apoplexy or even when an apoplectic stroke has already ensued. It has also been mentioned that convulsions, paralyses and other pathological results of cerebral hyperemia or cerebral hemorrhage may be alleviated by the same means. Besides these there exists, however, a series of nervous manifestations which may be palliated or allayed by a timely venesection.

#### EPILEPSY

It is evident that bloodletting must be of use in many instances of augmented intracranial pressure. Such increased pressure is invariably one of the prodromata of the genuine epileptic attack. I have employed bloodletting in cases of true epilepsy for nearly fifteen years. In about one-half of my cases I obtained very gratifying results, that is, the frequency and the severity of the attacks abated in a marked degree. Two of

my cases were apparently entirely cured. One of these was a promising actress twenty-four years old. Repeated epileptic seizures in the dressing room and even on the stage forced her to forego her histrionic career for the time being. The usual methods of treatment availed very little. A systolic blood pressure of 155 mm. Hg. prompted me to withdraw 300 c.c. (10 ounces) of blood in a tentative way. The pressure declined only about 5 mm. Hg., but the reduction seemed to be quite permanent. At any rate, it had not reached the former mark in the following two weeks. During this period no seizures had ensued. Before the bloodletting as many as two and three attacks had supervened in one week. Urged by the patient, who in meantime had become quite optimistic as regards her recovery, I then abstracted 500 c.c. (16 ounces) of blood. No attacks having ensued during the next three weeks, I again withdrew 300 c.c. (10 ounces) of blood. This procedure was repeated once during each of the following four months. The young woman soon after again took up her stage career, and is still pursuing it. She had no epileptic seizure since.

Quite recently this subject has again been approached by *Bram*, of Philadelphia. He reasons in the following manner: An epileptic seizure means, in the great majority of cases, an abrupt elevation of intracranial pressure. As soon as the pressure is reduced, the attack has ceased. The high intracranial pressure is presumably caused by the excessive amount of blood in the vascular system. A majority of epileptics are plethoric. This writer generally removes from 600 to 900 c.c. (20 to 30 ounces) of blood at one time. He believes that it is better to remove a few ounces of blood more than too little in patients who are subject to epileptic fits. In the six cases which he reports vene-

section had to be performed every two to six months. The indications presented by the patients for a subsequent abstraction of blood, according to the author, are a return of dizziness, "fulness in the head," and flushing of the skin. There are hardly any contraindications to bloodletting, he maintains, as the great majority of epileptics are plethoric. His experience is the same as mine, namely, that usually bloodletting alone is all that is needed by patients of this category. The following case, reported by *Bram*, and given in his own words, cannot fail to impress an interested circle:

"E. S., male, aged 17 years, had been suffering with true epilepsy for two years. At first the attacks would come on about once a month, but they had been gradually increasing in frequency so that during the past six months the patient had a typical epileptic fit every seven to twelve days. He appeared in my office for the first time July 12, 1912. The usual medicinal measures were prescribed, but three days later I was hurriedly summoned to his home, where his father had found him in a major fit in which he had fallen and struck his head violently upon some object, injuring the temporal artery. His father stated that he found him lying there in a pool of blood. When he recovered from this attack he was more than usually bright. His mentality was markedly improved, and there was no return of an attack for six weeks. Under ordinary circumstances he would have had five or six fits during that time. Following his next attack, six weeks after the injury to his blood vessel, I performed a venesection, removing thirty-two ounces (1 liter) of blood. The usual flush of his skin, dizziness, and headache were greatly reduced by this treatment. Ten weeks later he was again brought to me for venesection, because of the presence of premonitory symp-

toms, headache, flushing of the skin, and dizziness. There had been no attack since the first venesection! I again removed twenty ounces (600 c.c.) of blood and sent him home." The patient had no more seizures subsequently. The only treatment he receives is a venesection every twelve to fourteen weeks. The intervals between the blood abstractions are being gradually prolonged. The young patient is at present attending a college preparatory school and is well up in his studies.

## MIGRAINE

Every case of hemicrania and paroxysmal headache that has come under my observation during the past two years and a half I have subjected to "bloodless bloodletting." The results obtained thereby were, on the average, far superior than when the older modes of treatment were employed. True, in a certain proportion of the cases, phlebostasis proved useless. In most of the cases, on the other hand, phlebostasis subdued the acute symptoms of irritation or paralysis of the sympathetic within the period of a few minutes. Applied at the prodromal stage, the attack was often entirely averted. In a few instances the oft-repeated application of phlebostasis has practically removed the tendency to hemicranial headaches. The following brief case-history will exemplify this:

Widow, two children, 31 years of age. Had weekly attacks of hemicrania for over ten years. The usual methods of treatment, though occasionally ameliorating or limiting the acute symptoms, neither aborted an attack nor influenced the tendency to future seizures. Medium doses of fluid extract of ergot, prescribed by me on May 7, 1914, when the patient first came under my observation, subdued the tendency to the more severe outbreaks until October 8, 1914, when



a very violent hemicranial state, lasting for nearly 48 hours, supervened. From that time applications of phlebostasis were given every third day for one month. The phlebostasis chair, with its four inflating cuffs, two applied to the arms and two to the legs, was employed in this case. Each application lasted from thirty to forty-five minutes. On the day between the first and second application of phlebostasis a mild attack of paroxysmal headache, with its usual concomitants, occurred. Since that time the patient has been entirely well, has neither consulted a physician nor taken any medicine, except an occasional cathartic.

This case is by no means the only one of its kind that has been apparently cured by the bloodless method of bloodletting. This procedure is so entirely devoid of danger, and its application so simple that it ought to be given a trial in every case of migraine. The results are often surprising, and I have never met any more grateful patients than those whose hemicranial headaches are promptly, even if not permanently, relieved.

#### PSYCHOSES

Bloodletting produces no effect in the general run of brain diseases. There are, at least, no instances recorded in the more recent literature of successful treatment of the insane by blood abstraction. On the other hand, there is no doubt that certain nervous symptoms, such as sleeplessness, disquietude and delirious states of exaltation and excitement, are greatly ameliorated by bloodletting, as has already been mentioned in the chapter on narcomania.

As regards the employment of bloodletting in the psychoses, I will but add the following: There was a time in which the withdrawal of blood was exercised in each and every instance of maniacal excitement.

Though the most absurd and fantastic conceptions in respect to the etiology of the diseases of the brain were in vogue—they were ascribed to demoniacal obsession or to original sin having corrupted human character—and though the pathologico-anatomical substrate of the psychic disturbances was shrouded in complete darkness and mystery, there still existed the empirical knowledge that bloodletting acts as a sedative by virtue of the languor and drowsiness following in its wake. Truly, it was a very convenient remedy, and use of it was made without discrimination in all paroxysmal affections.

In modern text-books on psychiatry, bloodletting is hardly ever mentioned. However, if we inquire for the reason of this, the same answer will apply which must be given to the question, how did it come about that also in pneumonia and other diseases in which bloodletting was deemed a sovereign remedy it must reconquer the lost ground at this late date? Bloodletting was the fashion, the rage. It became discredited by the dreadful abuses attached to it. Bloodletting has not been the fashion in recent years, and it is for this very reason that modern psychiatry ignores it. In *Savage's* treatise I find in the chapter on mania the note that when there is a marked flow of blood to the head withdrawals of small amounts of blood may at times afford relief, but that larger quantities should never be abstracted. He bases this advice upon the view that mania is a state of exhaustion and that in its management rest and care are the principal remedial agents.

No mention whatever of bloodletting is made in the text-books and manuals on psychiatry by *Kräpelin*, *Dornblüth*, and other well-known authors.

In the meantime we have learned to emancipate our-

selves by critical investigation from therapeutical waves of fashion. And precisely this critical trend of thought must eventually, I opine, lead to the restoration of bloodletting in psychiatric practice.

Of course, it is out of the question to make any attempt at influencing organic alterations of the central nervous system by means of bloodletting. On the other hand, nothing, or at any rate very little, seems to bar its employment in the extensive field of the psychoneuroses. We know today that many psychic disorders are of a purely functional nature, being the result of hyperemia or anemia of the brain, exhaustion, autotoxicoes, exogenous intoxications, etc.

The more the psychiatrist appreciates the dependency of the psychoneuroses upon bodily conditions which stand in certain relations to the blood volume, the blood distribution and the blood composition, and the more he realizes that bloodletting not only deviates the blood from the brain, but also exerts regulatory and distributing qualities in all the internal organs, and the more exactly the conditions of local anemia and undernutrition are differentiated from those of hyperemia and its sequels, the sooner he will obtain clear-cut indications and contraindications for bloodletting in his special domain. I fear, however, that the psychiatrists, as a class, are in the throes of institutional lethargy, and that anything new pertaining to their line of work will not emanate from within, but from without, their ranks.

### B. Skin Diseases

I will at once say here that skin diseases of a parasitic nature can in no wise be influenced by bloodletting, at least not in a direct manner. Many cutaneous affections, however, are the result of malnutrition of the skin, or of autotoxic products, as is, for instance,

uremic pruritus, which is probably the most typical and authentic of all toxicodermatoses. It would scarcely occur to any one to resort to bloodletting on account of a case of uremic pruritus per se. Yet, this affection is not an infrequent early symptom of the uremic attack, and as such it is an indication for bloodletting not to be underestimated. One will, therefore, be on the safe side by performing the little operation immediately after a pruritus of uremic origin has made its appearance. In many cases the onset of the severer uremic manifestations may thus be aborted. The principal phenomena disappear together with their pathological substrates, which are either improved or entirely removed by the bleeding.

In recent years it was especially *Simond*, of the Heidelberg Dermatological Clinic, who made a clinical study of the effects of bloodletting in diseases of the skin. Until November, 1911, he had performed phlebotomy on about one hundred patients who were affected with skin lesions, as pruritus universalis, localized pruritus, pruritus senilis, various forms of urticaria, certain types of chronic eczema, psoriasis, chronic recurrent furunculosis, etc. He always employed an intravenous saline infusion together with the bloodletting.

The technic used by this author is the one in general employ. He abstracts from 100 to 200 c.c. (3 to 6 ounces) of blood by means of venepuncture. (Stern's trocar seems to be unknown to him.) Through the same cannula he infuses from 300 to 700 c.c. (10 to 23 ounces) of a 0.9 per cent. sterile NaCl solution. For theoretical reasons, the author does not employ any solution weaker than 0.9 per cent. He purposely abstracts but limited quantities of blood and infuses rather small volumes of salt solution, because he is

of the belief that the therapeutic effect by no means stands in direct relation to the volume of blood withdrawn and that of the saline solution infused. He is also of the opinion that, besides a stimulating action upon the processes of metabolism, nothing could be expected from bloodletting and a saline infusion. In this respect, however, he contradicts himself at the end of his essay, when he declares that bloodletting and salt infusion undoubtedly effect an alteration in the viscosity of the blood.

The best results with this combination treatment *Simond* obtained in pruritus. However, one may question the significance of favorable effects in pruritus, because psychical factors may play here an important part, and because the course of the disease is, altogether, of a rather fluctuating nature.

On this account the author took care not to draw the patients' attention to the circumstance that they were bled for therapeutic purposes, but rather left them under the impression that the blood was abstracted with the object of examining it.

The almost immediate effect of bloodletting in all of his cases was an arrest of the tormenting itching. In many of the cases it disappeared altogether. This improvement lasted generally from three to five days; after this period recurrences occurred quite frequently, chiefly on certain parts of the arms and legs. Repetition of the procedure effected the same favorable results on each occasion, until finally the pruritus disappeared altogether.

In psoriasis this treatment was not successful; on the other hand, marked improvement was observed in a case of chronic recurrent furunculosis of the neck. Good results were also obtained by this method of treatment in some forms of constitutional eczema.



### C. Diseases of Women

Bloodletting affects beneficially all those organs and parts of the body in which tension, distress or pain is the result of congestion. This fact accounts for its extensive employment in the various special departments of practical medicine. As far as gynecology is concerned, bloodletting is mostly performed in inflammatory conditions of the uterus and menstrual disturbances. Local, as well as systemic, abstraction of blood may be employed for this purpose. In cases, especially where palpitation, rush of blood to the brain, migraine, vertigo, etc., are due to scanty or absent menstruation or of other habitual hemorrhages, bleeding will most always relieve the existing plethoric condition. It is true, the local withdrawal of blood in gynecological affections is exercised day for day—in fact, the auspicious effects of some of the minor gynecological operations seem to solely depend upon the accompanying loss of blood. A general bloodletting, however, although particularly indicated in many cases, is rarely resorted to by the specialist for women's diseases. I shall not here enter into the reasons for this neglect. But the knell of the many useless and unnecessary gynecological operations has already been tolled.

### D. Diseases of the Eye

What has been stated in the foregoing paragraph applies to the practice of ophthalmology as well—in fact, to all the other specialties, namely, while the local abstractions of blood have acquired incontestable citizenship in the realm of therapeutics, general bloodletting at best is only in exceptional cases resorted to as an ameliorating or curative factor. To *Eversbusch* alone the credit is due that the scepticism as regards general bloodletting is vanishing even from the camp

of the ophthalmologists. I quote a case from the practice of Dr. H. N. Blum, of New Orleans, personally communicated to me, which may prove of interest to a larger circle.

The patient was a woman, 60 years of age, with acute glaucoma of the left eye. The right eye had been lost through the same disease four years previously. For the reason that an iridectomy was technically impossible in this case, and since there was a full, bounding and high-tension radial pulse, it was agreed between the attending physicians that bloodletting would be of much service. It was thought that this measure would assist in lowering the increased tension in the eye-ball. The abstraction of 500 c.c. (16 ounces) of blood accomplished an immediate decrease of the intraocular tension and the partial restoration of the anterior chamber. Some time later, iridectomy was performed under ether narcosis, and another 500 c.c. (16 ounces) of blood was removed.

Recovery of the eye was normal, and there was a rapid restoration of vision. Before the operation the patient could see her fingers at a distance of two to three feet. Two weeks after the operation the vision was 15/20 with correction.

The phlebotomy, Dr. Blum writes to me, proved a very useful procedure, judging by its effects upon the general circulation, and especially upon the circulation of the eye-ball. "I believe," he says, "that without the bloodletting the operation would have been extremely difficult, if not impossible, on account of the very marked increase in the intraocular tension. Because the right eye had been lost, we had to use every possible precaution to save the remaining eye, and an early operation under favorable conditions was much facilitated by the two general bloodlettings."

### E. Diseases of the Ears, Teeth and Gums

In affections of the ears, teeth and gums topical blood abstractions alone can be utilized. To enumerate every pathological eventuality of these organs in which inflammatory hyperemia and pain may be removed by the local withdrawal of blood, would lead me far beyond the boundaries set for this little treatise, and is entirely unnecessary. The thinking practitioner will find sufficient guidance in what has been said as to the rules and indications when and where to apply wet cups or leeches.

### F. Typhoid Fever

Infectious diseases as such have not found consideration in this monograph, for the simple reason that bloodletting exerts no demonstrable influence upon pathogenic microorganisms or their metabolic products. We also know that general bloodletting causes no antiphlogistic effects; we have, however, learned that hemorrhage in typhoid fever may be followed by an amelioration of the symptoms in general, and those on the part of the brain in particular. How these beneficial results are brought about cannot be stated with certainty at this day. Personally, I am of the opinion that a hemorrhage in typhoid fever may relieve the most marked symptoms in an entirely physical manner. *Whitehead* advised some years ago that the alleviating effects of hemorrhage in typhoid fever may possibly be procured by a prompt bloodletting, especially in severe and toxic cases. He also suggests the prophylactic use of bleeding in order to prevent the bad effects often following intestinal hemorrhage. *Rudolf* heartily concurs with this recommendation. He states that theoretically the method seems to be indicated in severe instances of the disease and that a moderate abstraction of blood—from 180 to 425 c.c.

(6 to 14 ounces)—is harmless and may yield a great deal of good. This author reports the following case, in which the results of the blood abstraction were especially marked:

Woman, aged 34 years. Admitted to hospital October 17, 1912. Duration of illness two weeks. Very toxic and paid no attention to surroundings. Lips dry and cracked. Tongue reddish brown. Spasmodic movement of chin. Hands tremulous. Abdomen distended and tympanitic. Spleen and liver palpable.

October 18. About the same. Seemed dazed, and at times picked at bedclothing. Temperature, 105 deg. F.; pulse, 110. In the evening 150 c.c. (5 ounces) of blood was drawn off from median basilic vein of left arm and 300 c.c. (10 ounces) of normal saline solution was injected into the vein. 6 P.M.: temperature, 106 deg. F.; pulse, 130. Whisky, half an ounce, every four hours. Cold colon douche. Ice pack. Caffeine gr. 1, aspirin grs. 2, and acetanilid gr.  $\frac{1}{4}$ , to be repeated in half an hour, and again in two hours if temperature did not lower.

October 19. 9 A.M.: temperature, 99 deg. F.; pulse, 88. Listless and weak. Muttered at times. Tongue dry and reddish brown. Lips dry. After this she continued very ill, but less desperately so, and by the end of the month was much better and left the hospital well before the end of the year.

## IX. BLOODLETTING IN CHILDREN

The history of bloodletting prior to the nineteenth century gives but scant mention of the employment of this therapeutic measure in children. The very fact, however, that ancient and medieval medicine would under ordinary circumstances not dispense with depletion justifies us in assuming that the children were subjected to the same procedure, although little special reference to this custom can be found. In Stöffler's "Calendarium romanum magnum" (1518) and in the "Medicina magica" (1568) it is stated that astrology, which influenced and pervaded the entire theory and practice of medicine of the times, accepted the theory that, according to situation and conjunction of the heavenly bodies, there existed favorable, dubious and unfavorable depletion days; the various periods of life had different days on which bloodletting was to be preferentially performed. (See "Historical Retrospect.")

The phase between half and full moon was deemed especially to favor depletion of young persons, but to be inimical to the operation in old people. In the olden times, in nurslings blood was certainly not often abstracted for therapeutic purposes.

The literature of the first half of the nineteenth century contains not infrequent allusions to bloodletting in children. On the whole, the opinions of the foremost clinicians of that period were opposed to it. According to a very brief historical sketch pertaining to this epoch and furnished by *Baginsky*, Bretonneau as well as Louis (1835) repudiated depletion in the treatment of diphtheria; the latter also renounced bloodletting in



pneumonia and erysipelas. Bailly and Legendre afterward declared against the procedure in bronchopneumonia (catarrhal pneumonia), but recognized its value in lobar pneumonia (fibrinous pneumonia). Among the Germans, Walther (1835), Wetzlar (1837) and Nasse (1849) expressed their opposition to blood abstraction in children. The pediatricist, Mauthner, of Vienna, on the other hand, was an energetic advocate of general and local depletion in children, especially in pneumonia and other febrile affections.

In a masterly discourse on the "Antiphlogistic Treatment in Diseases of Children," which is spread over five issues of the Medical Record of 1870 *Jacobi* also deals with the problem of bloodletting, and asks the question, "Are we justified in resorting to depletion at all?" He says:

"It is an established fact, or at least a very general conviction, that when we perform venesection—for the relief of pneumonia or meningitis, for example—we do not relieve the pneumonia or the meningitis itself, but we do relieve the collateral edema which has taken place in the tissues as yet uninvaded, or but partially invaded, by the inflammation. And by this relief of the collateral congestion and edema of the meninges or of the brain, we may save a patient from approaching dissolution. Such cases are rare; but when they occur, when we have to deal with acute edema, we must of course resort to depletion in many a case. I recall a case of convulsions in which I myself opened the jugular vein. I did not know the cause of the convulsion, but the venous congestion was so evident and so extreme, that I was led to relieve it as soon as possible. I think Trousseau relates a similar case. We know that the immediate danger in such cases depends not on the primary cause of the affection, but on the prolonged

congestion, which may give rise to effusion or extravasation. To avert these I do not object to venesection—indeed, it may become imperative. . . . But to depletion as a general antiphlogistic I must object, and this whether it be made by venesection or by local bloodletting. . . . We often hear of plethora, of surplus of blood; if such a condition ever occurs, it is certainly not in infancy. At that period any surplus would be sure to be used to build up the body, to contribute to growth.”

Accordingly *Jacobi* seldom resorted to depletion in inflammatory diseases of infancy and childhood, and, although meningeal and cerebral affections sometimes required direct depletion, he believes that generally, “wherever extensive derivation is really indicated,” stimulation of the emunctories will be more effective than a local withdrawal of blood about the head.

The literature from 1870 to 1890 contains very little anent the subject of depletion in the young. *Jewett*, in 1891, recommended moderate bleeding for young girls of full habit who suffer from menstrual irregularities, dysmenorrhea or temporary suspension of the flow, accompanied by flushed face, headache and a throbbing pulse. *Lissner*, in 1897, published the following interesting case:

A boy, eight years old, well developed, was affected with a mild form of scarlatina. The disease had about abated when a grave nephritis supervened. The eyelids were edematous; the urine contained about 1 per cent. albumin and showed, microscopically, white and red blood-cells, renal epithelia and numerous granular casts. The heart was normal, the pulse 96 per minute; there was increased tension; no temperature elevation. The usual therapeutic measures were ineffective. Urinary examination, performed daily, showed no decrease

of albumin; the general condition, which was fair at the onset, became worse. Without somnolence or other distinct premonitory symptoms uremia supervened suddenly, with four rapidly succeeding convulsive attacks, one of which lasted about half an hour and affected particularly the right half of the body. Chloroform inhalations caused momentary relief, but did not prevent repetition of the convulsive attacks, which ensued with greater frequency and intensity. The child was apparently moribund. As the pulse was still strong, however, venesection was resorted to, though very little hope was held out for recovery. About 100 c.c. blood was withdrawn from the right median cephalic vein. The result was more striking than any the observer had ever noticed following therapeutic intervention. Movements of the right arm were perceived even while the blood was still flowing. Three additional but very mild convulsive attacks ensued after depletion; the patient slept during the night. The subsequent course of the affection was also surprising; the urinary albumin decreased slowly but steadily; ten days later albumin was no longer found in the urine; the edema of the eyelids disappeared and the improvement in the general condition was rapid.

*Marfan*, in 1897, dwelling on therapeutic considerations concerning the diseases of childhood, remarks that general depletion should not be employed before the fourth or fifth year of life, because abstraction of body liquids below this age is not well borne. He maintains, on the other hand, that local depletion by means of leeches or wet cupping, which often yielded excellent results, may already be applied after the fifteenth month of life. Concerning the action of topical depletion he has to say the following:

“Ces émissions agissent d’une manière complexe,

à la fois par la soustraction d'une petite quantité de sang et par la révulsion, qui est très vive avec la ventouse scarifiée, très spéciale avec la sangsue."

At the onset of lobar pneumonia he applies one or two wet cups beneath the nipple of the affected side; in meningeal states and grave convulsions, one or two leeches behind the mastoid processes, or two or three wet cups on the nape of the neck will sometimes appease the untoward phenomena; and in cases of nephritis with anuria or uremia, he concludes, the application of from two to four leeches or wet cups over the lumbar region often constitutes a heroic treatment.

*Murray* in the same year published a note of caution concerning bloodletting in children. He says that when children are bled to faintness the recovery is slow and even convulsions and death may ensue.

The most important communications on the question before us were made by *Baginsky* in 1898 and 1901, respectively. In his first article he gives the histories of three of his cases:

Case 1.—Girl, aged seven and one-half years, affected with grave pneumonia and arrhythmia; facial pallor, cyanosis of the lips, extreme dyspnea; orthopneic posture; pulse not palpable; diffuse rhonchi; enlargement of liver; albuminuria with numerous anatomic elements. The increasing dyspnea, threatening the life of the child, the great restlessness and fear, prompted withdrawal of 120 c.c. of blood. This was very dark. Even while the process of depletion was still going on the intense cyanosis became relieved, the lips red, the pulse palpable, respiration slower. Sleep ensued. Recovery.

Case 2.—Boy, aged nine years, affected with pulmonary cirrhosis, bronchiectasis and asthmatic at-

tacks. Improvement ensued after abstraction of from 80 to 100 c.c. of blood.

“Case 3.—Girl, aged seven years. In June, 1897, she was treated in the hospital for pneumonia. Since then the child was ailing. Seriously sick for the previous few days, she was again admitted to the hospital December 19, 1897. Patient was suffering from extreme dyspnea and was nearly dead of exhaustion; respiration involved exertion of all respiratory muscles and strong movements of larynx and thorax; wings of the nostrils far apart and moved with respiration; cyanosis of lips; pulse not palpable; dull sound in place of cardiac sounds; loud bronchial râles. Injection of camphor and mustard bath produced no improvement; venesection resorted to; median vein of right arm first, that of left arm subsequently, were incised. But a few drops of blood escaped from either vein. The child was apparently moribund, and section of the radial artery seemed justifiable. About 80 c.c. of arterial blood was withdrawn. The blood was very dark. Cyanosis disappeared quickly, the pulse became palpable, dyspnea was relieved and the general condition became encouraging. The child stated that it felt better. Thoracic phenomena persisted for some time. A livid, morbilliform eruption had been present. The further course was undisturbed. The phenomena of a grave, diffuse bronchitis abated gradually; otitis media was intercurrent; the exanthema followed its normal course; the child was discharged as cured July 7, 1898.

On the strength of his clinical experience *Baginsky* maintains that venesection (or, if necessary, arteriotomy) must be frankly conceded to be a life-saving procedure, even in younger children, in the presence of an engorged right heart and consequent circulatory



difficulty. The fact that blood abstraction may prevent a fatal issue he ascribes to its purely mechanical effect; depletion relieves the engorged and incompetent heart and reestablishes the passage of the blood through heart and lungs; however, it is not effective in every instance in which it is indicated, as the cardiac muscle may be too far deteriorated to again functionate properly.

A brief article by *Gregor* of the Pediatric Clinic of Breslau University, published in 1900, deals with bloodletting in nurslings. He states that many physicians not rarely apply leeches in children under one year of age in the treatment of pneumonia or when there is suspicion of intracranial congestion. At the Breslau clinic venesection has been performed on nurslings between the fourth and eighth months of life when there existed extensive pulmonary disease. Depletion in these cases was, however, undertaken at a stage of the malady when, as a consequence of blood pressure decline, thrombosis of the opened vein ensued rapidly and the abstraction of sufficient amounts of blood was no longer possible. However, in a six-months-old nursing with bilateral pneumonia and imminent cardiac insufficiency, venesection was successfully applied; the child was brought through the exudative stage until, by the occurrence of a vicarious emphysema, the danger of respiratory insufficiency had been averted. *Gregor* is prompted by the happy issue of this case to employ venesection in nurslings affected with pneumonia (in cases in which one lung becomes rapidly involved after the other and digitalis proves ineffectual to regulate cardiac activity) at a time before the blood pressure has markedly decreased.

In an article devoted to venesection in uremia consequential to scarlatinal nephritis, *Singer*, in 1905, cham-

pions the therapeutic measure. He has observed nineteen cases of uremia in the course of scarlet fever. In all venesection was made use of. Fifteen patients recovered, four died. In eight instances the improvement was immediate; the convulsions ceased and consciousness reappeared at once. In children with a small, frequent pulse blood abstraction was followed by better results than when a pulse of different quality obtained. A filiform pulse contraindicates venesection. The operation, this author maintains, is particularly called for when cerebral irritation governs the picture of the disease. When a comatose state prevails the chance for recovery is not so favorable.

As I am not a pediatricist, my personal clinical experience with general depletion in children is naturally limited and dates back to my days of general practice, shortly after the time of the first article of Baginsky on the subject. I have performed venesection eight times in children, viz., in two cases of bronchopneumonia, one case of lobar pneumonia and five cases of uremia. In the cases of bronchopneumonia and lobar pneumonia resort to bloodletting was had too late in the course of the disease, and all the children died. Of the five children with uremic manifestations, three survived. Concerning one of the latter cases I gather from the brief notes in my possession the following:

A girl, aged seven years, exhibited the symptoms of postscarlatinal nephritis in the fourth, and those of uremia in the fifth week after the onset of the original affection. There were the usual nervous and urinary phenomena, the various edematous conditions, high vascular tension, dilated heart and subnormal temperature. To prevent edema of the lungs, which seemed imminent, blood was abstracted from the most prominent vein in each arm. Together about 60 c.c. was

withdrawn. The high tension subsided rapidly, the temperature (rectal) became elevated to 100 deg. F. within one hour, and the child was overcome with a natural sleep which lasted a few hours. After another week the child was out of danger; the swelling subsided, the urine had cleared up to a remarkable degree, and there were no undue cardiac or vascular manifestations. There was an uninterrupted recovery.

The opinion prevails among most of those who have contributed to the subject since the revival of bloodletting in the beginning of the nineties of the last century that early age, per se, offers no specific contraindication to the employment of this therapeutic procedure. In principle all these clinicians advocate bloodletting in suitable cases, although *Marfan* does not wish to see general depletion used in children under four years and topical depletion in those under fifteen months of life. On the other hand, the physicians of the Breslau Pediatric Clinic do not hesitate to take recourse to venesection in the nursling when it seems indicated (*Gregor*). *Singer* maintains that venesection is a potent and appropriate remedy in uremia arising in the course of scarlatinal nephritis, and he applies it in all types of children—the strong, the weak and the anemic; the only contraindication to bloodletting he recognizes is the presence of a filiform pulse. It goes without saying that general depletion is a much more energetic measure in children than in adults, principally for the reason that hematosiis is rather an uncertain and tedious process in early life, and it must not be forgotten that the infant needs every drop of its blood at the moment the acute condition demanding depletion has subsided.

The authors cited in the foregoing have obtained beneficial results from bloodletting, especially in in-

stances of pneumonia and of nephritis with uremic manifestations. These are also the principal affections for the treatment of which depletion has been employed in adults. Moreover, there seem to exist no special reasons why bloodletting in children should not be undertaken for the amelioration of the same pathologic state as in adults. Accordingly it may be indicated in affections of the heart and circulatory organs and diseases of the nervous system. *Baginsky* recounts the following diseases in which blood abstraction may become necessary in children: Pleuropneumonia, bronchopneumonia, capillary bronchitis with hyperemic manifestations, chronic heart disease, rapidly succeeding convulsions caused by hyperemia of the brain, and grave nephritides with uremic symptoms.

The action of general depletion in all these diseases is probably a mere mechanical one. In that group of affections in which orthopnea and dyspnea, regardless of their origin, dominate the acute clinical picture, the removal of adequate amounts of blood suddenly relieves the right heart, which, from the accumulation therein of venous blood, has become engorged, dilated and incompetent. In those clinical pictures in which coma or convulsive states overshadow the other manifestations bloodletting diminishes the underlying hyperemia of the brain, the irritation of the cerebral cortex and the vasoconstriction very likely in an entirely mechanical manner. Apart from the fact that a hemocathartic or detoxicating influence of bloodletting has never been fully demonstrated, the suddenness of the relief afforded in uremia stamps depletion as a mechanical or physical therapeutic agent.

In both groups of syndromes danger is imminent; on the one hand impending suffocation; on the other, coma or convulsions, while pulmonary edema is

threatening in either case. In all pertaining instances in which the child is apparently moribund, bloodletting is unreservedly indicated.

We know at the present day that depletion does not produce a general antiphlogistic or antipyretic effect; general bloodletting neither reduces the body temperature nor subdues inflammation. Our grandfathers in medicine considered nearly every disease to be of an inflammatory character, for which vigorous antiphlogistic treatment had to be instituted. Their antiphlogistic therapy consisted for the most part in bloodletting. *Jacobi* has given the death-blow to the practice of general antiphlogosis by depletion in children. In the treatment of the general run of acute diseases in children and infants blood abstraction is contraindicated unless the phenomena of suffocation, pulmonary edema, coma or convulsions, demanding mechanical relief, are paramount. On the other hand, topical bloodletting may exert a local antiphlogistic effect, as *Marfan* and others assert for the pediatric practice. Experimental proof of this clinical observation is not lacking. *Nicolas* has shown in the web of curarized frogs that clinging of leukocytes to the vessel wall and their transmigration, retardation of the blood current and, finally, stasis are manifestations of inflammation, while the opposite phenomena follow local blood abstraction, and consist of acceleration of the circulation, cessation of transmigration of leukocytes, their detachment from the vessel wall and resumption of their movements and activity in the increased blood current.

Bloodletting in children is distinctly contraindicated in instances of chronic hydremia and the cachectic states.

In local depletion the amount of blood withdrawn is always small. It is generally gauged by the number.



of leeches which have been applied. *Marfan*, as already mentioned, has given some practical hints as regards topical bleeding in a number of affections.

General depletion will prove of little or no avail if insufficient amounts of blood are abstracted. Yet, in children, the blood frequently ceases to flow before a sufficient quantity has been obtained. Under these circumstances it is often justifiable to resort to arteriotomy. The egress of the blood is livelier in the afternoon or evening than in the morning. Cold enhances coagulation and, hence, causes cessation of the blood flow. *Baginsky* declares that if the blood escapes normally and without interruption, the fifteenth or twentieth part of the entire blood of the child may be withdrawn with impunity. According to the same author if the entire blood of the child amounts to from one-fifteenth to one-twentieth of his body weight, the quantities of blood shown in the accompanying table may be abstracted:

TABLE SHOWING AMOUNT OF BLOOD THAT MAY BE SAFELY  
ABSTRACTED AT DIFFERENT AGES, ETC.

Years of Life.	Body Weight in Kilograms.	Total Amount of Blood in Kilograms.	Amount to be Withdrawn.
One . . . . .	10	0.66-0.5	45- 25 c.c.
Three . . . . .	12.5	0.85-0.62	65- 45 c.c.
Five . . . . .	16	1.1 -0.8	73- 50 c.c.
Seven . . . . .	20	1.3 -1.	85- 50 c.c.
Ten . . . . .	24.5	1.65-1.23	110- 85 c.c.
Fourteen . . . . .	38.5	2.57-1.92	170-100 c.c.

These are merely approximate amounts; occasionally more blood may be withdrawn, especially in cases of uremia. In other instances a smaller depletion may be safer for the child and still be sufficient to accomplish

the desired end. *Singer* mentions, relative to scarlatinal nephritis, that the amount of blood to be removed should be in proportion to the age of the patient and the severity of the attack. If bloodletting does not yield satisfactory results, so that neither the syndrome nor the patient's general condition changes materially, depletion may be repeated in from twelve to twenty-four hours.

General depletion may be accomplished by either arteriotomy, venesection or venepuncture. Arteriotomy should be resorted to in cases of existing or imminent pulmonary edema, although *Rieder* expressly states that this operation is no longer performed at this late day. It should, moreover, be undertaken only by one who has sufficient surgical experience. (See p. 80.) In the great majority of cases, however, the blood is withdrawn from a vein. Prior to the era of aseptic surgery phlebotomy, as has been mentioned, was effected by means of a spring-lancet; in modern times the little operation is performed with the scalpel. In children like in adults one of the veins of the arm may be incised; the median, the median cephalic or median basilic vein are best suited for the purpose. In other instances the blood may be obtained from one of the saphenous veins in the leg. In children though, especially in infants, the veins of the arms are little prominent and are more or less hidden by goodly layers of adipose tissue. *Baginsky* recommends the free dissection of the vein and a long incision into it. Venepuncture, whenever applicable, is that method of blood abstraction which should be given preference. On account of the little prominence of the arm veins and the comparatively extensive fatty bolster in the young subject, it is probably not possible to employ it as frequently in children as

in adults. The little blood, on the other hand, which it is often possible to obtain from one vein only, should prove no contraindication to the employment of venepuncture; the small puncture wound is of no account and the instrument may be inserted into a number of veins until the desired amount of blood has been secured. In children the walls of the veins are not as tough as in adult life, and great care must be exercised that the needle or trocar enters the vein without penetrating it on the other side. Despite the fact that venepuncture is not as easy of application in children as in grown up persons, it is still superior to venesection in many respects. This has been explained in detail in the chapter dealing with the technic of bloodletting.

## X. PROPHYLACTIC POSSIBILITIES OF BLOOD- LETTING

A retrospect of the long line of diseases in which local or general bloodletting renders useful service—symptomatically, at least—and not infrequently proves itself even a life-saving procedure, evinces that the abstraction of blood may not only be a therapeutic agent in existing disease, but also be a possible preventative of no mean value. In the “good old times,” as we learned from the historical introduction, prophylactic venesection played a far greater rôle than it does today. The men of the renaissance were cast in a different mold, were more robust and less neurotic, than their epigones. As chemical anesthetics were, of course, unknown a few hundred years ago, it was quite customary to induce syncope, an absolute essential for the performance of the more extensive operations, by a copious bloodletting preceding the surgical interference proper. The loss of blood during the operation was then in consequence of the already diminished blood pressure somewhat less than in anesthesia effected by chemical means. Nevertheless, it would not occur to a modern surgeon to eliminate pain and the muscular reaction by means of blood withdrawal.

However, prophylactic bloodletting was not only employed to bring the patient into a dead faint and to produce the necessary pliability and relaxation in him, but for other purposes as well. Periodical bloodlettings were generally considered conducive to health, particularly at the time of favorable constellations. The barber sharpened his lancet probably as often

and as assiduously as his razor. Man and woman, rich and poor, high and low, ignorant and savant, high-born and humble—all were bled at certain periods, even when no physical ills were complained of.

Of course, prophylactic bloodletting cannot be applied to this almost unlimited extent in this enlightened age. Medical vampirism is and remains an absurdity of the past. Still, there is a not inconsiderable field for the employment of preventive venesection. The principal pathological states in which preventive bloodletting may serve a good purpose receive a brief recapitulation in the following:

It has already been demonstrated at some length that bloodletting may prevent a threatening pulmonary or cardiac collapse, as well as cerebral apoplexy, in a purely mechanical manner by altering the blood volume and blood distribution. *Markham*, when dealing in his book with the changes in the typical course of disease as effected by bloodletting, very properly points out that this procedure, when timely resorted to, admits of a more favorable prognosis by forestalling dangerous symptoms. To be sure, the book of this author has been antiquated for a long time, but no matter how much he erred as regards the causes to which he ascribes the effects of bloodletting, the fact remains that the typical course of the disease is favorably influenced by the operation. But, strictly speaking, this rather pertains to therapy. I only mention it here for the sake of completeness, because in this connection bloodletting serves as a prophylactic measure at the same time.

Bloodletting is a sovereign prophylactic when employed in combatting the evil effects following a high blood pressure of long duration. It is especially indicated when it is paramount that satisfactory results



be rapidly attained. Although there is no doubt that the effect of blood abstraction in high pressure cases, in part at least, is also a purely mechanical one, still it is an accepted fact that bloodletting exerts quite an important influence upon the physical characteristics of the blood. The blood alterations effected by phlebotomy, it is true, are not of an enduring nature in the general run of the cases; nevertheless, the increased metabolism following the blood abstraction persists for some time, and this is a factor that may be of benefit to many a patient. Of course, an adequate amount of blood must be withdrawn from the organism by such prophylactic bleedings. The average volume of blood that might be removed for prophylactic purposes at one time, in instances of disease accompanied by high blood pressure, should be from 200 to 500 c.c. (6 to 16 ounces). It is self-evident that the procedure may and should be repeated in the same patient from time to time.

One of the principal physical changes taking place in the blood after abstraction is the lowering of its viscosity, as has again been demonstrated by *Melis-Schirru*. This experimenter has demonstrated that the viscosity of the blood serum becomes markedly diminished after the withdrawal of even small amounts of blood (200 to 250 c.c. = 6 to 8 ounces).

This phenomenon becomes already apparent within one hour after the operation, reaches its point of culmination about five hours later, and then slowly declines. After twenty-four hours a distinct decrease of the blood viscosity is, however, still noticeable.

Prophylactic bloodletting is of especial importance in certain types of albuminuria, and also in nephritides. In the former it certainly gives rise to an improvement of the general condition and often to the disappearance

of the urinary albumin; in nephritides it maintains the patient at least in statu quo and prevents the terminal uremia. In cases of albuminuria it is advisable to usher in with the bloodletting a combined abstinence and rest cure. The forms of albuminuria which are particularly amenable to this combined method of treatment are those in which the urinary proteid is derived from the lymph channels (lymphuria).

In the chapter on narcomania I have pointed out that the sleep which follows an adequate depletion is refreshing in an extraordinary manner, and being thus conducive to the alleviation of many affections of the nervous system. Whenever sleep is insufficient or entirely lacking by reason of nervous unrest, excitement, persistent cerebral hyperemia, etc., pernicious and even calamitous consequences are bound to ensue sooner or later. It is here that bloodletting is an excellent preventative. Sometimes the pleasant languor, which may be observed even after minor bloodlettings, suffices to effectively avert the untoward circumstances resulting from persistent states of excitement. Many times a single abstraction of blood, by inducing a profound and long-lasting sleep, will arrest the further deterioration of the nervous apparatus, or even palliate the entire pathological state. In any event, half a dozen bloodlettings performed within a period of from six to twelve weeks are ample to act as a dependable prophylactic in serious cases of nervous decline.

In this connection, it seems to me that a wide and fruitful field offers itself to the prophylactic employment of bloodletting in many cases of neurasthenia and psychasthenia. As soon as the inaugural symptoms of these abnormal conditions manifest themselves, the patient, provided he be well otherwise, should be subjected to this prophylactic procedure. I could de-

scribe a small number of pertinent cases in which I have obtained good results by the removal of from 250 to 350 c.c. (8 to 12 ounces) of blood. I almost feel tempted to attribute the cause of the so innumerable cases of psycho-neurasthenia with which the modern clinician is confronted, to the fact that prophylactic depletion has fallen into such an extraordinary, inexplicable and entirely undeserved desuetude. Our grandfathers were bled for every trivial ailment, for every headache, every pain in the muscles or joints and, in general, for every or almost every indisposition. Probably as a result of this, neurasthenia was comparatively rare among them. The blood flowed calmly through their veins, and, all in all, they were members of a steady-going generation. We grandsons do no longer submit ourselves to the periodical sway of the lancet, but we are an unsettled, fickle and neurasthenic race.

This brings me to another question which, however, I shall abstain from discussing in detail in this place, viz., the prophylactic employment of bloodletting, enacted by law, in habitual drunkards, offenders against morality, homosexuals and criminals of various types. The reader of this book, who has followed me to this juncture, will be able to fully appreciate the wholesome effect of blood abstraction in the pertaining cases. A new perspective is thus thrown open to prophylactic (as well as to therapeutic) bloodletting, the proper recognition and significance of which may prove a boon to Society.

It is unavoidable that at first many uncalled persons will crowd into the practice of prophylactic bloodletting, and that it will be subjected to more or less abuse. Its employment, however, should be left entirely to the judgment of the experienced medical ad-

viser, and he alone should be entitled to perform the little operation, be it for purposes of prevention or of treatment. Bloodletting belongs neither in the domain of the barber, the orderly, the nurse and the masseur, nor in the province of Christian Science and other pseudo-religions.

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